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THE CLINICAL STUDY AND TREATMENT OF SICK CHILDREN

THE CLINICAL STUDY AND TREATMENT OF SICK CHILDREN

BY

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PREFACE TO THE THIRD EDITION

THE favourable reception given to the two former editions of this book has been an encouragement to bring the work up to date in a third. This should have appeared years ago, had it not been for the lack of leisure inevitable in war-time.

In re-writing the book, which is now more than three times the size of the first edition, I have tried to adhere as much as possible to the original plan. I have said little about pathology, but have dealt fully with clinical methods, clinical symptoms and clinical descriptions of those diseases which are either peculiar to children or show characteristic differences when they occur in early life. I have not restricted myself entirely to common ailments, and have been largely guided in the choice of subjects by my own experience and predilections; believing that the best way to secure the reader's interest is to tell him what the writer is himself most keenly interested in.

An attempt has been made to give exact references in the text to as many as possible of the papers in periodical literature which have given me useful information and suggestions. I cannot sufficiently acknowledge the constant assistance and inspiration derived from the works and personal instruction of such authorities as Ashby, Barlow, Lees and Eustace Smith, from L. E. Holt and other distinguished members of the American Pediatric Society, and from some continental writers—especially Professor Henoch.

From my colleagues at the Children's Hospital, especially Dr J. S. Fowler, Mr John Fraser, Dr Charles M'Neil and Sir Harold Stiles, I have received much valuable criticism; and my friends Sir James Mackenzie, Professor Lorrain Smith and Dr Logan Turner have given me help and encouragement throughout. I am especially indebted to my former house-physician, Dr Edith Bronson of San Francisco, whose wide knowledge of recent literature and excellent judgment in clinical

matters have been placed ungrudgingly at my disposal, and have been of the greatest service. The help of other friends is acknowledged elsewhere.

Dr C. J. W. Dixon, Dr C. M'Neil, and Mr H. B. Thomson, have given assistance in seeing the book through the press, and have eliminated many errors by careful and critical proof-reading.

January 1921.

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INTRODUCTION

THE subject of the diseases of children is sometimes spoken of as a speciality, but if it is to be regarded as a special field in the domain of medical science at all, it is certainly one which lies beyond, and not parallel to that occupied by ordinary clinical medicine, and it is only through the latter that it can be reached. It is much better not to begin the study of disease in children until familiarity with its symptoms in later life has been acquired.

Infancy and childhood should then be the most interesting periods of life to the physician. It is while they last that his services are most frequently called for, and most indispensable; it is then that he can study disease in its frankest and least complicated forms; and it is then, also, that he is able most satisfactorily to control every circumstance that can act on the patient's health, and therefore ensure the best chance of recovery. It is in little children, too, that the physician's great ally, the Vis Medicatrix Naturæ, is present in fullest activity; and consequently, although the mortality is much higher in early childhood than at any other time of life, it is then also that we have by far the largest number of therapeutic successes, and are most frequently cheered by unexpected recoveries.

To the student or practitioner who has hitherto been concerned only with the examination and treatment of adults, the study of disease in childhood is indeed apt to present great difficulties at first, but when these have been surmounted, he finds their ailments at least as easy of diagnosis and treatment as those of his other patients.

To be successful in practice among children, certain qualifications are absolutely necessary to the physician.

Firstly, he must, of course, possess a thorough grasp of the ordinary clinical methods.

Secondly, a certain amount of tact is necessary to enable him to examine the patient without arousing active opposition.

Many have this tact instinctively; some only acquire it in the requisite degree with time and experience; while to those who have no liking for children, and are out of sympathy with them, it may never come at all.

Lastly, he must have made himself familiar with the chief anatomical and physiological peculiarities of childhood, so as to know what is and what is not within the normal limits; and he must have some knowledge of the nature and causes of the diseases commonest among children.

In the following pages, an attempt is made to supply this necessary information, and to indicate its relation to clinical work, in the hope of arousing some of that interest which, as Dr Moxon said, "neutralises difficulties as alkalies neutralise acids."

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THE CLINICAL STUDY AND TREATMENT OF SICK CHILDREN

CHAPTER I

ON GENERAL CLINICAL EXAMINATION, CLINICAL HISTORY, AND PHYSIOGNOMICAL DIAGNOSIS

General Clinical Examination.

THE methods of clinical examination in older children are the same as those used for adults and can be applied in the same order. In infants and little children, however, the examination may have to be hastened and its details considerably modified, because the patient is unable to endure it for more than a very short time.

In the first place, *our methods differ somewhat in their relative value* in children and adults. Thus, inspection plays a larger part in the diagnosis of disease in infancy than it does in later life. This is partly because it is more easy of application, as children are usually stripped for examination, and are thus more easily seen. Partly also because they show more readily by their gestures and expression what they are feeling, and the signs of present disorder are less often in them than in adults obscured by the traces of past disease. Palpation also is much more applicable to children than to grown-up patients, not only because their bodies are smaller and softer, but also because they are so used to being handled all over by their mothers and nurses that it is not to them the unusual and unpleasant process that it is to adults.

There is usually also *considerable difference in the order in which the methods are to be used.* In adults, we generally follow habitually much the same order of procedure—such as is found

in the ordinary case-taking forms—although it may be varied somewhat in different cases. In children, the order is changed, in accordance with the general rule that it is always better to take the more unpleasant parts of the examination last, so that any inevitable crying and resistance may be deferred as long as possible. For example, the mouth and throat are among the last parts to be inspected. Were they examined early, in many cases the child would begin to cry, and the further investigation of his organs be rendered more difficult. Similarly, as some children are frightened by even light percussion, it is better as a rule to auscultate first, and to percuss afterwards. Again, it is important to count the pulse and respiration early, before the child has been much disturbed.

As a general rule, while in examining adults we proceed *system by system*, investigating in turn the alimentary, circulatory, respiratory, and other organs, in children we go rather *by methods*, so to speak; inspecting first as much as we can without touching, then palpating all over, then auscultating, and so on. There are, however, many exceptions to this rule.

Routine Examination.

Before discussing the examination of the different parts of the body, it will be well to describe briefly the investigation of an ordinary case so as to illustrate the usual order of proceeding. Of course most physicians have their own order, and that given here, which is founded on Dr Charles West's chapter on the subject, is only offered as one of many which work well.

To begin with, then, preferably before the child is seen, it is essential to make careful *preliminary inquiries* into his history and symptoms, so as to know to what point especially attention should be directed. It is also advisable that the child should be stripped before the examination is begun. If he is hurriedly undressed in the presence of a stranger, it is almost sure to make him cross. It is best, therefore, if possible, to begin with, to have him rolled in a blanket, with or without a loose night-dress on, and on his mother's or nurse's knee. Little children, even when they are seriously ill and feverish, are generally better there than in bed, because they feel safer and are less easily put out. If the child is able to sit up he should always be examined as much as possible sitting, and only subjected

to the annoyance of being laid down when it seems quite necessary.

The investigation commences with *inspection*, but it is very important not to go close to the child and stare at him. If you do, he is very likely to cry. Sit first a little way off and finish your conversation with his mother or nurse. While you are doing so, unobserved by him, notice as much as you can. Observe his demeanour and expression, the state of his development and nutrition, his complexion, the condition of his skin and hair, and the form of his head and any other uncovered parts; also, whether he has signs of rickets or syphilis, or any other disease past or present. Notice whether he is listless or lively, good-natured or irritable, and whether his behaviour is that of a normal child or in any way abnormal. Note also if his respiration is difficult; and, if he cries or coughs, observe the character of the sounds he makes, and count the respirations.

Then comes *palpation*, and by this time the child has got a little used to your presence, and may allow you to feel his pulse without apparently noticing that you are doing so. It is essential to count the pulse without annoying or frightening him, because otherwise it will be so quickened by his emotional excitement that its enumeration will be useless. If the child is shy, it is well to let his mother hold his hand in hers while you are feeling his pulse, as this makes it less likely that he will move it.

You will next lay your hand (*thoroughly warm, of course*) on the abdomen, before the child is laid down or his body uncovered. While palpating thus you learn the condition of the skin, its temperature (approximately), and whether it is soft and normal, or dry and harsh as in chronic wasting disease. On deeper palpation you will learn something of the size of the liver and spleen, and the presence of any abnormal swelling or tenderness. The hand may then be passed over the thorax, where you will feel the amount of rickety beading, if any be present, the position and character of the heart's impulse, and if there is any epigastric pulsation. You may also find rhonchal fremitus over the lungs or a thrill over the heart. The limbs should then be felt, and their size, muscularity, and other characteristics estimated.

The hand is then passed over the head, its temperature and degree of moisture noticed, and the state of the fontanelle and

the presence or absence of cranio-tabes investigated. The neck also should be felt, and the exact position of any enlarged lymphatic glands made out.

Auscultation, if the child is nervous (and clean), may be practised first by the ear being laid to the chest with only the nightdress or a handkerchief intervening. For thorough examination, however, the stethoscope should always be used, and a binaural with a short chest-piece (or, preferably, with Bowles' flat chest-piece, which slips easily under clothes and round the child's sides) is the most useful form.

It is well to auscultate the back first, as it is the commonest site of many lesions (*e.g.* empyema and collapse). It is also the place where fluid sounds in the bronchi are most likely to be heard, if the infant, as is probable, has been lying down.

Percussion follows auscultation. It must always be light, and care must be taken to see that the child is sitting straight.

Last of all, the mouth and tongue have to be inspected, and the gums and fauces seen and, if necessary, felt. This is usually the most unpleasant part of the whole process from the child's point of view, and is therefore best deferred until the end. The temperature may be taken before the examination begins, or at any period during it.

Should the child be *asleep*, it is important to examine him before he wakes, so far as is possible, noting the character of his sleep, whether quiet or restless, and the attitude he assumes (see p. 34). It is also very important to count the respiration and feel the pulse before the child wakes, as this may be the only opportunity of ascertaining their undisturbed condition. If he has any noises accompanying his breathing when awake, note if they are also present during sleep, and if so, to what degree. In many cases the abdomen may be palpated freely and the heart auscultated during sleep; some children are not aroused even by the use of the ophthalmoscope. If the child has to be wakened, this should be done by the mother or nurse, and in any case a strange face should not, if possible, be the first to meet his eye.

Clinical History.

The importance of a full and accurate clinical history can scarcely be overestimated. It makes the physical examina-

tion easier and shorter, and saves us from many mistakes. Such a history is generally far more easily obtained in the case of children than in that of adults. Of course, as is so constantly pointed out, the child cannot tell us much about his own troubles. On the other hand, we can usually get our facts from his mother, who has watched him hourly, and to whom his least symptom is a matter of absorbing interest. Her story, if often rambling, is at least more trustworthy than much that adult patients tell us about themselves.

The theories of the mother and nurse as to the cause of the child's illness are usually of no value, but their opinions as to whether he is getting better or worse are never to be made light of. While, however, we may often rely on the mother's description of past symptoms, we must never trust to her account of the urine or fæces, or of any fact of the case which we can investigate for ourselves.

A "method of caes-taking" is certainly helpful in clinical work. The form in use at the Edinburgh Children's Hospital will be found in Appendix A. A few remarks may be made on some of the questions to be asked.

Mother's Complaints.—It is always important, to begin with, to ascertain why the mother has brought the child for advice—which of his ailments, that is to say, bulks most largely in *her* estimation.

Family History.—The family history is also important in some cases, especially in connection with the diagnosis of tuberculous, rheumatic, and nervous cases. We must also inquire about the mother's health, particularly whether she was well during her pregnancy. The number of other children should also be ascertained and where the patient comes in the family; and it is well to find out whether any of the other children have suffered from tuberculosis, congenital syphilis, or any other special disease.

Previous Health and Treatment.—In investigating the former medical history of a case, you should begin by asking about the nature of the labour and the state of the child at birth. His growth and development of body and mind must then be inquired into; when his *teeth* appeared, when he first began to *walk* and to *talk*, and so on. It is of great importance also in young children to know about the previous feeding. Whether the child was on the breast, and if so, for how long;

if not, what he was given instead of the breast-milk, and at what age he first got solid food. It is also important to know what sort of diet he has recently been getting.

You will then inquire about previous symptoms of disease. A history of "snuffles" and a peculiar rash in early infancy may be important as indicating congenital syphilis. Recurrent attacks of bronchitis, with alternate constipation and diarrhœa and muscular debility, would suggest the probability of previous rickets. The occurrence and dates of attacks of infectious disease are always important. In the case of obscure acute symptoms, the fact of the patient's having been recently exposed to the infection of one of the exanthemata may greatly aid in the diagnosis, and the periods of incubation of these must be kept in mind.[1] Sometimes the fact that an attack of measles or whooping-cough has preceded an obscure illness by a few months is a point in favour of the case being one of tuberculosis.

The Present Illness.—It is often very difficult to get a clear account of the present illness. It is best to begin by ascertaining its duration, and this is done by finding out the exact date when the child was last evidently in his normal state; and then to ask about the ways in which he has since shown that he is not well—his sleep, appetite, energy, temper, appearance, and complaints.

Physiognomical Diagnosis.

Before entering upon a description of the different organs and parts of the body, it will be well to consider briefly the advantage to be gained from a study of the appearance and expression of the child's face, and the attitude of his body and limbs. Physiognomical diagnosis is easier in children than in older people, because the child's face is comparatively free from those lines and furrows which are regarded in adults as denoting character; and consequently it is the more easy to read when it bears the impress of disease. Physiognomical diagnosis is specially useful in children, partly because it frequently tells us, at once, which organ most needs investigation, and so shortens our examination; partly also because it often affords us the only satisfactory means we have of answering the important question, "How is the child feeling?" The answer to this

[1] See Appendix B.

question may be very helpful. If, for example, the child is obviously feeling well, we can be quite sure that he has neither infantile scurvy, anal fissure, nor acute pyelitis, however suggestive of these diseases the other symptoms may be.

While physiognomical diagnosis, however, should be practised on all occasions, it is extremely important not to trust to it for such information as can only be acquired with accuracy by the ordinary and more laborious methods of examination. If it is employed as a substitute for, instead of as an introduction

FIG. 1.—Pleuro-pneumonia, before the crisis. Boy of 22 months.

FIG. 2.—Pleuro-pneumonia, a week after the crisis. The same child.

to, a more methodical examination, the result will be far from satisfactory. Skill in reading the significance of the gestures and facial changes is only acquired by long practice. A few of the changes which are most frequently met with are well seen in the accompanying photographs. In indicating some of the more important points to be observed in them I shall make free use of Professor Soltmann's valuable paper on the subject.[1]

Pleuro-pneumonia.—The first photograph (Fig. 1) is of a boy of twenty-two months taken on the fifth day of an attack of

[1] "Ueber das Mienen- und Geberdenspiel kranker Kinder," *Jahrbuch für Kinderheilkunde*, 1887, xxvi., 206.

acute pleuro-pneumonia which involved part of the base of the right lung.

The child is too ill to notice much or to hold up his head, which is lying back on his mother's arm. His face is flushed and his eyes bright, although their expression is dull and anxious. His eyebrows are oblique from the action of the corrugator supercilii on each side along with that of the central bundle of the frontalis. His nostrils are dilated and working, the angles of the mouth are lowered and the lips slightly parted so as to admit more air during the laboured breathing. The general expression of the child's face is that of suffering, modified by the desire not to cry because of the pain which a long breath would cause.

Fig. 2 represents the same child nine days later, after the temperature had been normal for more than a week. The abnormal points in Fig. 1 become much more evident when you compare it with this one. Here the child is thinner, but his general expression is that of health, comfort, and intelligent observation.

Meningitis.—Figs. 3 to 7 illustrate the physiognomy of brain disease. This is an important facies to recognise, because in so many cases the other symptoms of brain disease are equivocal during the early stage, and it may be doubtful whether the lesion is in the cranium, the chest, or the abdomen. Under these circumstances much may be learned from the expression of the face.

The look that brain disease gives to a baby's face is a very strange one, because it suggests the presence of emotions which are quite foreign to infancy. This is seen in a striking way in Figs. 3 and 5, which represent a baby of five months who was dying of basic meningitis.

His eyes are closed, and he is knitting his brows. According to Professor Soltmann, it is the hyperæmia of the retina associated with the brain condition which produces this effect on the face, just as bright light might do. The central irritation is producing very tight contraction of the masseters, and there is also some retraction of the head. The general aspect of the upper half of the face is that of deep and earnest thought, while the clenched jaw and slight drawing back of the head give almost the impression of stern determination. Although the baby is much emaciated his fontanelle is full and bulging.

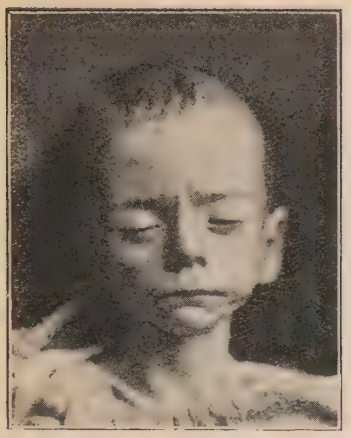

FIG. 3.—Moribund Basic Meningitis.
Boy of 3 months.

FIG. 4.—Tuberculous Meningitis.
Girl of 11 months.

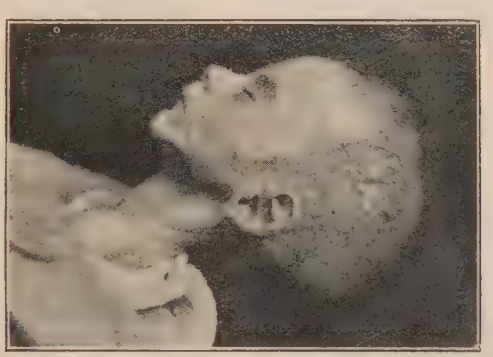

FIG. 5.—Same as Fig. 3.

FIGS. 6 and 7.—Tuberculous Meningitis. Boy of 2 years.

Figs. 4, 6, and 7 represent infants suffering from tuberculous meningitis. The unchildlike look of profound meditation, as well as (in Fig. 4) the squint and unequal opening of the sightless eyes, are very noticeable.

FIG. 8.—Acute Suppurative Peritonitis. Girl of 19 months.

Facies of Acute General Peritonitis. — In cases of abdominal suppuration (appendicitis, etc.) where the infection has spread to the general peritoneum, a facies is often seen which is apt to be mistaken for that of meningitis. A good instance of this is represented in Fig. 8. Note the sunken eyes and the drawing down of the angles of the mouth. When this facies is well marked it generally indicates that the time for successful surgical interference has passed.

Risus Sardonicus.—This is seen in children with tetanus, and is helpful in the diagnosis in the early stages of slight cases (Figs. 9 and 10).

FIG. 9.—Tetanus. Boy of 5 years.

FIG. 10.—Tetanus. Girl of $3\frac{9}{12}$ years.

The Hippocratic Facies of Impending Death.—Fig. 11 represents an infant, aged ten months, dying from severe septicæmia with diarrhœa and broncho-pneumonia. The child was evidently delirious, grasping in the air in front of her, as if she saw things. Note the hollow staring eyes, the dilated nostrils, and the dropping of the lower jaw. This photograph

may be taken as representing the "facies Hippocratica" as it is seen in an infant. Hippocrates, in describing a dying man, speaks of the "sharp nose, hollow eyes, collapsed temples, the ears cold, contracted, and their lobes turned out. The skin about the forehead being rough, distended, and parched; the colour of the whole face being green, black, livid, or lead-coloured."

Adenoid Facies.—Fig. 12 represents the common appearance of the face seen in children suffering from obstruction of the naso-pharynx by adenoid vegetations. There is a general dull expression, and the mouth is almost constantly

FIG. 11.—Facies Hippocratica. Girl of 10 months.

FIG. 12.—Adenoid Facies.

open. The nostrils are very narrow, the alæ nasi are defective and present a more or less distinct dimple at the junction of the superior and inferior lateral cartilages. Owing to accompanying nasal catarrh there is often, as there was in this case, a tendency to running at the nose, and its extremity is apt to be red, especially in cold weather.

The degree to which the adenoid physiognomy is present indicates the amount of obstruction to the process of nasal breathing rather than the amount of the adenoid vegetations. The latter may be present in considerable bulk, and may be doing harm in reflex and other ways; but if they do not obstruct the free entrance of air through the naso-pharynx, they will not cause this alteration of the facial appearance.

Asthma, etc.—In some cases of asthma and in cases of severe chest deformity (*e.g.* from Pott's disease), in which

FIG. 13.—Acute Nephritis.

FIG. 14.—Same child after recovery.

the extraordinary muscles of respiration are habitually over-acting, there is an opposite condition to the adenoid physiognomy. In children with such affections the eyes tend to be unusually bright, the nostrils large, well developed, and widely open, and the mouth firmly closed.

Acute Bright's Disease.—Fig. 13 shows the swollen and puffy appearance of the face characteristic of acute nephritis, and Fig. 14 the same child after recovery.

Acute Diarrhœa and Vomiting.—Fig. 15 shows the staring eyes, with deep hollows round them, which are characteristic of babies with acute vomiting and diarrhœa. This facies is the exact opposite of that in acute nephritis; for here the tissues of the

FIG. 15.—Acute Diarrhœa and Vomiting. Girl of 11 months.

face and orbit, instead of being water-logged as in nephritis, are shrunken for want of the fluids of which the acute vomiting and diarrhœa have deprived them. In cases such as this the subcutaneous injection of saline solution will very rapidly bring a more normal appearance to the face, besides raising the level of the sunken fontanelle.

Chronic Diarrhœa.—Children with chronic diarrhœa often have an expression of disgust and aversion. It is probable that this is merely the result of a constant bad taste in the mouth in a child rendered weak and irritable by exhausting disease.

CHAPTER II

ON SOME FACTS OF GROWTH AND DEVELOPMENT

Growth in Weight.

THE average weight of a new-born baby is 7 lbs. or thereby (5 to 12). During the first two days of life there is usually a loss which may amount to as much as 8 or 10 oz. This is partly due to the passage of urine and meconium, and partly to the fact that the child does not receive enough nourishment from the breasts to make up for the tissue waste. On the third day a steady rise usually begins and the birth-weight is reached again, on an average, by the tenth day of life.

After this, the rise continues more or less steadily, the infant gaining from $\frac{2}{3}$ to 1 oz. daily during the first five months, and from $\frac{1}{3}$ to $\frac{2}{3}$ oz. daily during the rest of the first year. The gain may vary from day to day, but the average daily increase for the week will be at about that rate.

By the end of the fourth month the baby's weight should be nearly double what it was at birth, and by the end of the first year about three times the original figure. During the second year the child gains 5 to 6 lbs.; during the third about $4\frac{1}{2}$ lbs.; and during the fourth, fifth, and sixth, about 4 lbs. a year. By the end of the sixth year the weight is somewhere about six times the birth-weight, and by fourteen years double that figure. The average weight at any age may be seen from the accompanying charts (Figs. 16 and 17).

An infant who is very small at birth generally takes a long time to reach the average weight; and a bottle-fed child gains more slowly, other things being equal, than a breast-baby. There are, of course, wide variations within the limits of health.

Clinical Significance.—The advantage, from a clinical point of view, of weighing children regularly is very great. In scientific infant-feeding, and in the treatment of food-disorders, it is indeed quite indispensable. The weight should be noted once a week in ordinary cases, and in food-disorders it is often well to take it daily. By observing it we are able to estimate more simply and surely than in any other way the extent to which a particular diet is being assimilated. An interruption in

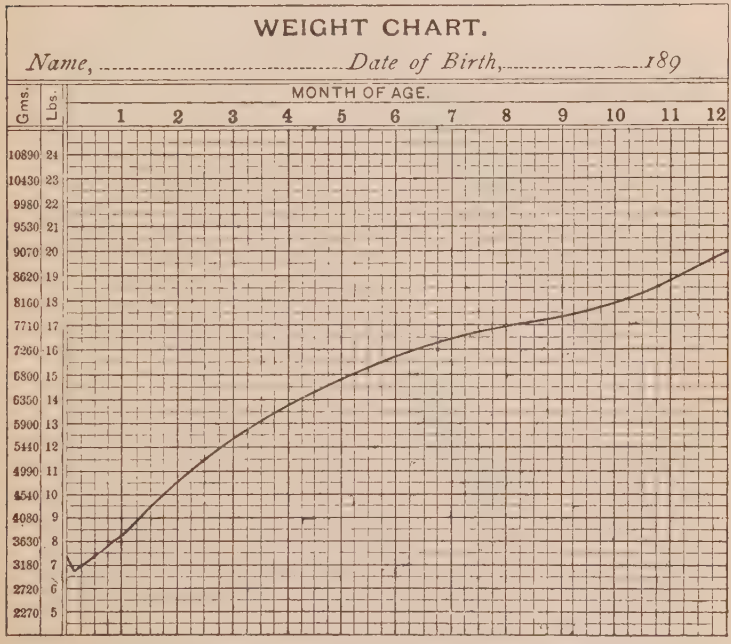

FIG. 16.—The Weight Curve of the first year (Holt).

the gain will often show that a new diet is not being properly digested, although it has not, as yet, caused any of the more obvious symptoms of dyspepsia. The course of the weight curve is, in many cases, both a source of encouragement and a valuable guide to treatment; for, if it is altogether satisfactory in character and the baby vigorous, we may be quite sure that all is going well with him in spite of any other symptoms that might have aroused anxiety.

Various temporary disturbances of mind as well as of body, may cause an arrest, for a time, of a child's gain in weight.

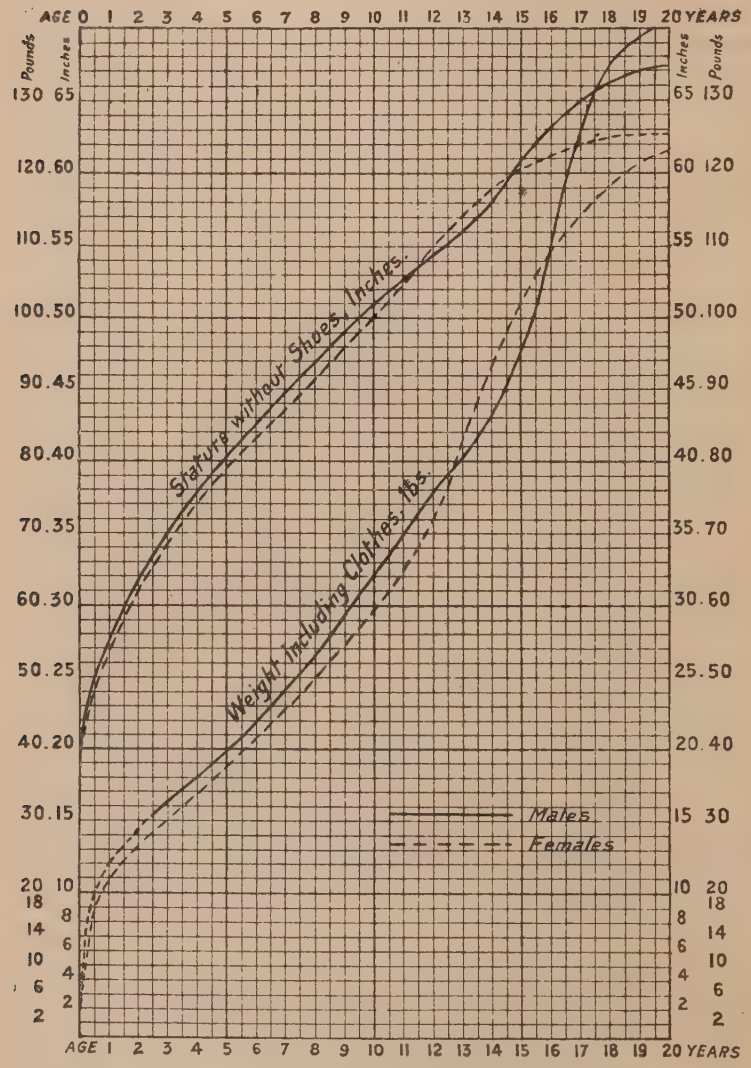

FIG. 17.—Chart showing average Stature and Weight of both Sexes under 20 years.

(*From the Report of the Royal Commission on Physical Training (Scotland)*, vol. i., 1908.)

Some babies, for example, lose to some extent during their first week in a hospital ward, without any change of diet; and, afterwards, when used to their surroundings, fatten satisfactorily on the same treatment. Slight ailments of any kind, and also the cutting of teeth, often stop the gain temporarily.

Whenever a young child is losing weight, or even not gaining it for many weeks, this is to be regarded as an important fact, the cause of which must be investigated. It is equivalent to progressive emaciation in the adult, and is never to be quietly acquiesced in, however free the child seems from other symptoms. A baby that is not gaining weight properly has a lowered resistance to disease, and is failing to lay in the stock of strength by which he is to hold his own in the trials of later life. Such a child, though often regarded as satisfactory by his parents, is really in constant danger of succumbing to some comparatively slight chest or bowel attack which would not have harmed a better nourished baby.

Although, in most cases, a growing weight means that the infant is thriving, we not very rarely meet with instances in which it has a less favourable explanation. Certain forms of feeding cause an abnormal rise in the weight curve. For example, an increase of cane sugar in the food may do so, the rise being so rapid and so considerable that it is obviously out of proportion to any possible effect which the new food could have had, in the time, on the child's nutrition. It is practically certain that this misleading gain is due to the large proportion of the sugar having produced an increased retention of fluid in the tissues. A rise in weight of this sort is often seen in infants who have been gaining slowly on modified cow's milk, when they are given ordinary sweetened condensed milk or one of the sugary proprietary foods. The increase of weight is not usually accompanied by any obvious signs of œdema. A diminution of the sugar in the food may, similarly, cause a sudden disproportionate drop in the weight curve.

Another common cause of such a retention of fluid in the tissues is an excess of salts in the food. This is often seen when the child is fed on cow's milk. Finkelstein has drawn attention to the striking difference between the steady uninterrupted rise of weight which occurs in normal babies on

breast-milk and the zigzag weight curves which are so often seen in hand-fed infants (Chapter IX., p. 177). He attributes the irregularities in the weight curves of the bottle-fed babies to the alternate retention and excretion of the larger amount of salts in the cow's milk. He has also shown that valuable aid may be obtained from the weight chart in recognising different types of food disorder.

In any weakly baby of a few months who is in an advanced state of marasmus there is a strong tendency to the occurrence of superficial œdema. When such an infant has shown little or no gain for some time, and then becomes suddenly heavier, we must always look out for puffiness of the skin on the back, face, or extremities.

In infants who are suffering from tuberculous disease, a sudden gain is to be regarded as suspicious, and should lead us to examine for fluid accumulations in the peritoneum and pleuræ.

In older children, as well as in infants, a temporary loss of weight is an important sign of many morbid conditions. In institutions in which the children are weighed regularly, as a matter of routine, it is found that the steady rise of their weight is often checked at once by a severe catarrh or a sore throat. The same thing is noticed during the latter half of the incubation period in measles. Another example of the practical importance of weighing children regularly is afforded in the course of some cases of empyema. Cases of this kind in which there is a small localised collection of pus are not uncommon in childhood. They may, not infrequently, be cured by one or more aspirations. After the pus has been removed, however, it is often impossible to make sure from a physical examination alone whether it is, or is not, reaccumulating. The question can usually be settled by weighing the child periodically. So long as the pus is slowly gathering again, the child does not gain weight; and, conversely, if there is a satisfactory gain in weight, without a great increase in the local dullness, we may be sure that there is no need of further tapping.

Emaciation. — Chronic emaciation in young children is generally due to dyspepsia or to improper feeding, but it may be caused by tuberculosis or some other serious chronic disease. In older children it may be the result of tuberculous disease,

of diabetes, or of hysteria or some other nervous affection. Far the commonest cause of obstinate emaciation at this age, however, is chronic intestinal indigestion (p. 254).

Obesity.—When children show an excess of subcutaneous fat, it is generally distributed more equally over the body and is less markedly abdominal in situation than is usual in adults. In most cases the excess is due to overfeeding—especially with carbohydrates and fats; and the resulting interference with exercise tends to increase it. There is reason to suspect, however, that in some cases and in some families the obesity is due to a constitutional defect in metabolism, and not merely to overfeeding. It is known that such defects in metabolism often depend on a morbid condition of one of the endocrine organs. It may be caused by deficient secretion of the pituitary or thyroid, or by a tumour in the pineal gland or in the suprarenal cortex; when the pituitary or thyroid secretion is defective, there is usually an abnormally increased tolerance for glucose.

The treatment of obesity in children consists in cautious restriction of the diet and in carefully regulated exercise. Thyroid substance may be tried if there is reason to suspect that the thyroid secretion is defective; but it should not be given indiscriminately to all fat children. None of the other drugs recommended for obesity are of any practical value.

Progressive Lipodystrophia.—In connection with emaciation and obesity, a rare and interesting abnormality may be mentioned which has recently been described as "progressive lipodystrophia,"[1] as in many of the published cases the symptoms have begun in childhood. The chief characteristic of the condition consists in a progressive symmetrical loss of subcutaneous fat in the upper half of the body, which is usually most strikingly seen in the face and chest. While these parts of the body waste, the lower limbs show an increasing plumpness, so that the contrast becomes very noticeable. Most of the patients hitherto described have been girls. The muscles remain normal, there is no tendency to infantilism and no other symptom. The general health is quite unaffected.

[1] Feer, *Jahrb. f. Kinderheilk.*, 1915, lxxxii., 1; C. Herrman, *Arch. Int. Med.*, April 1916, xvii., 516; F. Parkes Weber, *Quart. Journ. Med.*, 1917, x., No. 38, 131.

Growth in Length.

At birth the child measures, on an average, $19\frac{1}{2}$ to $20\frac{1}{2}$ inches in length. During the first year he grows about 8 inches; during the second he gains from 3 to 5 inches; during the third, from 2 to $3\frac{1}{2}$ inches; and in the fourth, and thereafter till the eleventh or twelfth year, from 2 to 3 inches yearly. Between the eleventh and fourteenth years girls are rather taller than boys of the same age. By the end of the fifth year the child has generally doubled his original length.

The growth in height shows distinct periodical variations. It is less in boys between nine and fourteen, and in girls between eight and eleven, than it is immediately before or after these ages. It also varies at different seasons of the year, being greatest in the spring and summer months (April to August), less between August and November, and least during the winter. The average height, at a given age, of children of the well-to-do classes is greater than that found among the poor; and there are, of course, wide variations within normal limits.

Clinical Significance.—The infant's growth in length has not been nearly so fully studied as his gain in weight. Variot[1] has made special investigations on the subject, and has pointed out various facts regarding it which are of great clinical interest and importance.

The normal baby adds to his length continuously from birth. Although, under ordinary conditions, the increase in weight and that in length usually run a somewhat parallel course, they are really quite independent of one another. This is seen even in the first days of life for, during the rapid loss of weight which normally takes place at that time, the gain in length proceeds very actively, so that he grows $\frac{2}{3}$ inch in the first fortnight and about $1\frac{1}{2}$ inches in the first month; and half of his first year's growth has often occurred by the time he is three months old. In later childhood also there is evidence, from time to time, of a physiological dissociation of the weight and length curves; for the length often continues growing while the weight is stationary, and generally grows most rapidly when the gain in weight is slow.

[1] *La Clinique Infantile*, 1905, iii., 323; 1908, vi., 385, 496, and 609; 1909, vii., 193; 1911, ix., 217; 1914, xii., 289; also Hubert, *ibid.*, 1910, viii., 462.

Although the weight chart gives us all the information we usually need in estimating the development of the normal baby, it is important in the abnormal infant to take the growth in length into account also. It is in premature and debilitated babies that the dissociation of the growth in weight and length shows most and lasts longest. When a baby is suffering seriously from atrophy, his length increases while his weight falls, just as happens in typhoid and other serious illnesses in later life.

Variot[1] and Lassablière have found that, after the second month, the relation between the growth in length and the nutritive requirements is so constant that they regard the former as a trustworthy guide to the amount of food the child should have. They estimate that 14 grammes of breast-milk are needed for each centimetre of the infant's length.

Although arrest of the growth in length is most often due to gastro-intestinal disturbance, it is also characteristic of various other diseases such as tuberculosis, congenital syphilis, and rickets; and Hess[2] has found that prolonged infantile scurvy also exerts a striking influence of this sort, and that antiscorbutic treatment is followed at once by greatly increased growth in length. It is sometimes a serious mistake to regulate the amount of a wasted baby's meals according to his weight only; for, if this is done, he may get far too little for his needs. Variot has also pointed out[3] that the date of appearance of the centres of ossification in the bones of the phalanges and metacarpus varies with the growth in length and not with the gain in weight. This is illustrated in a striking way in cretinism and achondroplasia, and in most of the other forms of disease which cause dwarfing, for in them the ossification of these bones is very greatly retarded.

In estimating the state of nutrition in school children, the innumerable observations which have been made regarding the relation of their height and weight to their age have proved of very little practical value. As Holt has pointed out,[4] the only really important point to ascertain is the relation of weight to height. This, along with the annual rate of increase in

[1] *La Clinique Infantile*, 1908, vi., 641; 1909, vii., 225.
[2] *Amer. Journ. Dis. Child.*, Aug. 1916, xii., 165.
[3] *La Clinique Infantile*, 1906, iv., 685.
[4] *Amer. Journ. Dis. Child.*, Dec. 1918, xvi., 359.

weight and height, and the general appearance and bodily conformation of the child are the chief data from which the examiner can form a just estimate of the nutrition.

In dealing with deficient stature we must, especially in older children, distinguish between simple arrest of growth, or **dwarfing**, and the same condition associated with infantilism. In simple dwarfing the development of the sexual organs, with its accompanying changes in other parts of the body, proceeds

FIG. 18.—Pancreatic Infantilism. Boy of 25 years. Died of Diabetes in 33rd year.

in the ordinary way; while in **infantilism** the child retains his infantile proportions and contour, and, as he grows older, there is a delay in those changes in the genital organs, larynx, and elsewhere which announce the approach of puberty. It is generally, though not always, accompanied by dwarfing.

Infantilism is found in an extreme degree in cretinism, and it is one of the symptoms to be looked for in the slight cases of that disease which are so apt to be overlooked. It is also, though to a less extent, characteristic of defect of pituitary

secretion. Serious affections of other organs such as the liver,[1] pancreas[2] (Fig. 18), and kidneys[3] may also produce it, and it is one of the most characteristic manifestations of the form of chronic diarrhœa which is known as "cœliac disease" (p. 259). Some degree of infantilism is also common in many other prolonged debilitating diseases, such as malformations of the heart, congenital syphilis, and chronic tuberculous bone affections, and in some cases of cerebral diplegia, as well as in many other organic lesions of the brain.

In cases of dwarfing with infantilism for which there is no obvious cause, it is well to try the effect of thyroid in small

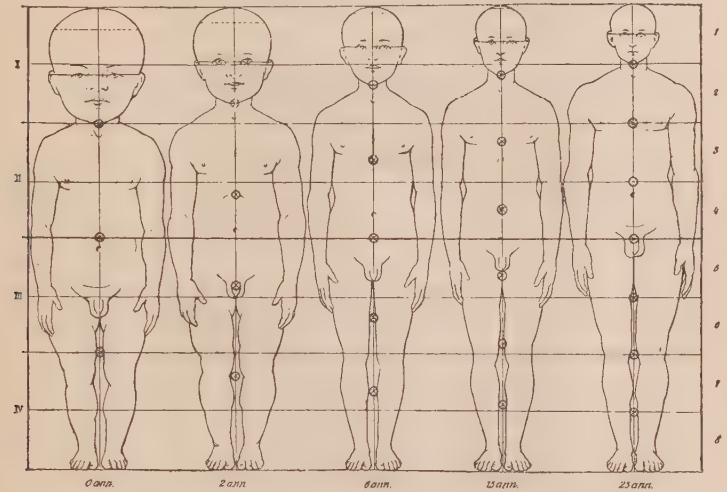

FIG. 19.—Relative Proportions of the Body at different Ages (Stratz).

doses. If such a case depends on athyria, the result of this treatment on growth and development is rapid and striking; and there are some cases in which stunted growth depends on defective thyroid action, although the children show no other characteristic sign of cretinism (see p. 424).

Premature Sexual Development.—The converse of infantilism is occasionally, though rarely, met with. It is found especially in cases of tumour of the pineal gland, and in some forms of cortical hypernephromata (see p. 434).

[1] Lereboullet, *Les Cirrhoses Biliaires*, Paris, 1902, 76.

[2] Byrom Bramwell, *Scot. Med. and Surg. Journ.*, 1904, xiv., 321.

[3] R. Miller and L. Parsons, *Brit. Journ. Child. Dis.*, 1912, ix., 289; and A. E. Naish, *ibid.*, 337.

When we compare the *proportions* of infants with those of older children and adults, we notice that their limbs are relatively short compared with the trunk, and that the circumference of the head and abdomen are large compared with that of the thorax. This is well shown in the accompanying diagram (Fig. 19) taken from Stratz's beautiful work, *Der Körper des Kindes* (Stuttgart, 1904). These differences gradually disappear owing to the different rate of growth of those parts.

Young parents not infrequently suffer from unnecessary anxiety on account of a supposed enlargement of the head or belly of perfectly healthy children, owing to their overlooking these facts.

Development of the Sensory Functions and their Testing for Clinical Purposes.

Sight.—Very soon after birth a baby is able to distinguish light from darkness, but it is a long time before his eyes afford him much information. After the first few weeks most infants manifest distinct signs of pleasure when they are shown a shining object or a moderately bright light, and try to follow it. A restless baby may often be quieted for examination by being carried to a window. By the third month a normal child should show that to some extent he recognises his mother's face. By the sixth, he should recognise many things; but for some time after he seems to know what they are, he will be unable to estimate their distance from him, and will grasp at them when they are quite beyond his reach.

Bright colours please infants of even a few weeks old, probably only because of their brightness, but the power to discriminate between colours is comparatively long in developing. Red and yellow may rarely be recognised in the first twelve months; blue and green not generally till the close of the second, or during the third year.

In older children we *test the eyesight* by the same methods as are used in examining adults. In infants and young children a thorough examination is of course impossible, but, with care, the main facts required can often be ascertained. To test a baby's power of seeing, we may watch whether his eyes follow a moving light, and if he seems to notice familiar sights unaccompanied by sounds. Thus, it may be observed

at what distance he responds to his mother's smile, or recognises an approaching bottle at meal times; and, when he is older, the identification of such familiar and welcome objects as a penny or an orange forms a suitable test of vision.

It should also be noticed if the pupils contract with light, and, if the child is more than a few months old, with accommodation. It is sometimes interesting when testing the vision to bring the point of the finger suddenly close to the child's cornea without touching it, and observe whether this makes him wink. In normal babies under two months this manœuvre does not cause winking.

In using the *ophthalmoscope* to examine children's eyes, the indirect method is the more useful. It may be necessary to separate the eyelids gently with the finger and thumb to get a good view through the pupil, but the less the child is touched during the examination, the less likely is he to resent it. If the baby is sound asleep, the examination should be attempted before he awakes, as the light may not rouse him; and if it does not, there is a better chance of seeing the disc then than there will be after he awakes. Remember that the distribution of the choroid pigment is often irregular in infancy, and that physiological peculiarities in this matter are apt to be mistaken for the results of disease.

As Dr Maddox first pointed out to me, the images produced by the *reflection of light on each cornea* are helpful in the examination of children's eyes in two ways. In the first place, by noticing the exact position of the image when the disc is in sight, we may be assisted in finding it again without losing unnecessary time. Again, the comparison of the position of the corneal images in the two eyes may lead to the detection of a squint.

Photophobia is sometimes met with as a symptom of a general morbid condition. It is common during the onset of measles and influenza, and it is also an early symptom of tuberculous meningitis and cerebral hyperæmia. It is, of course, often due to local disease of the eye, and may in rare cases be caused by peripheral irritation from the mouth (p. 42).

Errors of Refraction.—If there is any suspicion that the eyesight is defective, the refraction should be examined, and any error present corrected, without delay. It is to be remembered that while *hypermetropia* and *astigmatism* are

congenital defects, *myopia* is only acquired in later childhood, although the tendency to it is often hereditary. It is comparatively rare to find it before the sixth year, and it becomes increasingly common and severe during school life. A great deal can be done to prevent its increase by insisting on care in using the eyes, not holding the book too close or stooping over it, and not reading with insufficient light. These precautions may be relaxed as the child gets older, and are no longer necessary after twenty.

Recurrent Functional Micropsia.—This name may be given to a trivial disturbance of vision which is not very rare in older children. Its presence is usually only discovered by questioning, as it does not cause any great distress. Sometimes, however, if it recurs frequently and lasts long at a time, the annoyance it gives rise to is considerable; and the medical man may be consulted either on this account or because it has suggested anxiety as to the condition of the child's eyes.

More or less suddenly the child finds that the furniture and other objects in the room appear much smaller than usual—as if they were three or four times as far away as they really are—although their details are as clear, or clearer, than before. After a few minutes this passes off, and it sometimes seems to go sooner if an attempt is made to focus the sight on a near object, such as the hand. While the micropsia lasts it interferes with reading.

There is no obvious cause for the onset of the symptom. Sometimes it comes on when the child wakens in the morning, sometimes in the evening when he is tired and sleepy, but it may begin at any time in the day; and it is not only when much eye-work is being done that it appears. I have known it to occur with a high degree of myopia, also with quite normal vision; with chronic dyspepsia and with apparently perfect digestion. It is not associated with headache or giddiness.

The micropsia varies greatly in degree and in the frequency of its recurrence. It often begins about the tenth year, and ceases altogether between twenty and twenty-five, if not sooner; and it may cease temporarily for months or years during childhood or adolescence, and then recur without any obvious cause. The explanation of its occurrence is obscure,

but it seems to depend on a passing relaxation of accommodation. It is apparently of no importance with regard either to the child's general health or to his vision, but possibly it may have some relation to a strained condition of the nervous system.

Blindness.—Want of sight, apart from any obvious disease in the eyes, occurs under various conditions in childhood. In infants apparent blindness, with a normal fundus and normal media, is a common indication of mental defect.

Temporary blindness sometimes occurs in basic meningitis and chronic hydrocephalus, when the fluid is increasing. It may last for months, but usually recovers completely. We may also occasionally see children who have become temporarily blind in the course of whooping cough or uræmia, and especially after severe convulsive attacks accompanied by coma. In these the blindness may persist for weeks or months; the pupils are usually normal and active.[1]

Blind Children.[2]—The parents of blind children often stand greatly in need of guidance. Without it they are very apt to train the child in infancy in such a way that when he comes to school age he is not only unnecessarily backward but has much to unlearn. The main points to remember are that the child must always be treated, so far as is possible, as if he were able to see, and that nothing should be done for him that he can be taught to do for himself. When he is able to crawl he must be encouraged to move about everywhere as freely as possible without getting into actual danger. In this way he learns by experience, from the knocks he gets, how to take care of himself. He must be taught early to wash, dress, and feed himself; and he cannot be too carefully trained to be neat and methodical. Toys are a valuable source of instruction and do much to train the mind as well as the hands. Such occupations as threading small beads are especially good for him, as they help to develop the sensitiveness of his finger-tips in a way that will be useful to him when he comes to learn the Braille alphabet. The use of

[1] Ashby and Stephenson, *Rep. Soc. for Study of Dis. in Child.*, 1903, iii., 197.

[2] See W. B. Drummond, *Introduction to Child Study*, London, 1907, 325. An excellent leaflet of *Suggestions to the Parents and Friends of Blind Children* can be obtained at the Central Office of the Charity Organisation Society, 15 Buckingham Street, Adelphi, London, W.C. 2.

dumb-bells and other forms of physical drill is important, and especially open-air exercise.

The wonderful acuteness of hearing and touch which blind people show is not a free gift of Nature; it is simply the result of unlimited painstaking practice. To this, therefore, the child should early be encouraged.

A very important thing for the parents of blind children to remember is the strong tendency they have to acquire objectionable tricks and habits, such as swaying backwards and forwards and grimacing. These must be watched for and checked at once. If they are practised for any time, they are exceedingly difficult to stop; and, if allowed to continue, they form a serious drawback in later life.

Congenital Word-Blindness or **Visual Aphasia.**[1] — In examining school children who have difficulty in learning to read, it is important to remember the symptoms of congenital word-blindness; because if it is not looked for, the child may be thought deficient in mind or eyesight and wrongly treated.

When this condition is well marked the child, though he sees well and is quite intelligent, cannot be taught to recognise printed letters or words, or in some cases, figures. The visual centre is all right, and so is that for the interpretation of what is seen, but the path between them has remained undeveloped. In many of the mild cases the patient has no difficulty with figures, and may know single letters when he sees them, but he cannot recognise even short words by sight. Thus he may recognise the picture of a cat at once, and be quite able to name the letters c, a, and t, separately; and yet he will puzzle for an indefinite time over the word "cat" unless he is told to spell it aloud. When he does so, he at once names it correctly. He cannot take in the word at a glance, as a normal child does, but only sees the separate letters; yet, when he names the letters, he knows at once what they spell. To put it otherwise, if the letters enter his head by the eyes, they remain separate and without meaning to him; but, if by the ears, they go straight to where they are formed into words, and he sees their significance without difficulty. Such children have generally a good memory for sounds, and this must be taken advantage of in their training. They require careful special teaching, and with time and patience, they can be greatly improved, even in bad cases.

[1] James Hinshelwood, *Congenital Word-Blindness* (Lewis), London, 1917.

Hearing.—During the first day or two of life all children are deaf; but by the second week, if not earlier, they should be able to hear loud noises quite well. If a child pays no attention to a loud sound behind him by the fourth week, he is probably either deaf or mentally deficient. By about the end of the third month the child can usually recognise the direction of a noise and turn towards it. It is much longer, however, before children can distinguish between different sounds. Thus, among one hundred normal children, Demme found only two who seemed to recognise their mother's voice by three and a half months. Often they are much later in doing so. By six months, most babies like being sung to, and young infants generally seem pleased by jingling and rattling noises. If an infant on the bottle who seems in good health shows no interest when the sounds of the usual preparations for a meal are being made, although he cannot see them, it is probable that either his hearing or his intellect is at fault.

In examining infants' ears we must remember the shortness of the external meatus, which is such that a speculum is often scarcely necessary; and also the obliquity of the tympanic membrane. In testing a young child's hearing, a watch is of little use. The child should be placed so that he cannot see the examiner's lips, and made to repeat short words after him. A simple way to test the hearing in young children is to shake the closed fists simultaneously, one on either side of him—one of the hands being empty and the other containing a couple of coins. If he hears, the child will generally turn at once to the fist in which the coins jingle.

Hyperacusia.—An abnormal tendency to start at any sudden sound is a common symptom in various forms of nervous instability. An exaggerated form of this is often met with in cases of spastic diplegia and in cerebro-spinal meningitis.

Deafness, should, of course, always lead to an examination of the ears, and of the naso-pharynx for adenoids. Complete deafness sometimes sets in suddenly, without any sign of middle-ear disease, during cerebro-spinal meningitis, mumps, and whooping cough, and in the course of congenital syphilis in older children. In all such cases the prognosis as to recovery of hearing is exceedingly bad. In deafness from otitis media the extreme importance of persistent carrying out of the treatment must always be impressed on the parents.

A lesser degree of *impaired hearing* is very common; and, just because it is not complete and the child evidently hears loud sounds, it is apt to be neglected by the parents. Such partial deafness interferes greatly with a child's school-work, and, when it occurs early, with his learning to speak.

Deaf Children.[1]—Like the blind, the deaf and dumb child should be treated as much as possible as if he were normal. This is much easier in his case owing to his normal appearance. Indeed, he looks so normal that his deafness is often overlooked until he is two or three years old. He should be talked to just as if he heard, and encouraged always to watch the speaker's lips. He may not at first learn much in this way, but it will make the learning of lip-reading easier to him afterwards. The deaf child is usually too observant to learn awkward habits as the blind are apt to do. His chief morbid tendency is towards getting self-centred and irritable. For this, mixing freely with normal children, who are friendly and do not tease him, is the best remedy.

Congenital Word-Deafness.[2]—This is a condition analogous to congenital word-blindness, but it is even less common. Children who suffer from it have good hearing and good sense. The higher centre which receives the sounds, and that which interprets them, are both normal, but the path between them is defective. When the child is spoken to, he pays no attention and is thought to be deaf till it is found that he is at once attracted by music, even when it is not loud, or by any household sound in which he is interested. Speech, in these cases, is naturally not acquired at the usual age, but it can be learned in time, although at first the child repeats the words and sentences after his teacher, as a parrot does, without attaching any meaning to them. The treatment consists in training the patient in lip-reading. He finds it comparatively easy to recognise words which he sees on the speaker's lips.

Both Taste and Smell are relatively well developed within the first few days of life. They do not, however, acquire a great deal of acuteness until later childhood. It is seldom necessary to examine them in children for clinical purposes. When it is, familiar articles of food form the best tests. Little

[1] See W. B. Drummond, *loc. cit.*, 328.

[2] C. J. Thomas, *Child Study*, January 1904, i., No. 4, 97.

children often show a liking for tastes which are unpleasant to adults.

The **Sensibility** of the child to **Touch**, **Temperature**, and **Pain** is not very acute at birth, but it soon increases. The testing of these sensations in young children demands infinite tact and patience, and often leads to little result. It is always well to repeat the observations several times, on separate occasions, before being sure of their accuracy.

Thiemich has pointed out[1] that habitual presence of general analgesia (to pin-pricks) is characteristic of imbeciles even in babyhood, and that they also often show a distinct defect of taste.

Development of the Voluntary Motor Functions.

The young infant has a fair amount of muscular force at his disposal, but his movements at first are mostly not voluntary. Some of them are *random* or *aimless*, being apparently the expression of a mere overflow of energy. Such are the grimacing, kicking, opening and shutting of the fists, and so on, which are so characteristic of the new-born baby. Others, like the blinking which follows a flash of light or a puff of wind, are simply *reflex*. The crying and sneezing of the child at birth are also of this nature.

Then there are movements which may be classed as merely *instinctive*. In these, reflex action plays a certain part, but they are also definitely purposive. The human baby at birth has very few of these actions except sucking. There is another interesting movement of this nature, however, to which attention was drawn by Dr Louis Robinson.[2] When an adult's finger or other similar object is put within a new-born baby's grasp, his fingers close on it tightly. When the finger is raised the child's instinctive grasp is so strong that he can be lifted right off the bed without its relaxing. This power of holding on is quite different from the voluntary grasping of older babies, and it is lost within a few days of birth. Dr Robinson inclines to connect it with the arboreal habits of distant ancestors. The so-called "infantile form" of the plantar reflex (p. 553) is perhaps another movement

[1] *Deutsche Med. Wochenschr.*, 1900, xxvi., 34.

[2] "Infantile Atavism," *Brit. Med. Journ.*, 1891, ii., 1226.

of this kind. Movements which are *voluntary* as well as instinctive are only gradually acquired as the child gets older. Examples of these are—holding up the head, grasping, sitting, creeping, standing, and walking.

A baby is usually unable to *hold his head erect* until he is three or four months old, according to the degree of his muscular development.

If a finger is laid in an infant's palm it is generally promptly *grasped*, and if the child is over five months old it will probably also be carried towards his mouth. Should the child's fingers show no inclination to close on an object placed in his palm, it is a morbid sign, suggesting usually either severe present illness, paralysis, or great mental impairment.

The power *to sit up* appears at a time which varies with the vigour of the individual baby. A child, however, cannot generally sit, even for a short time, until he is six or eight months old, and then only if carefully propped up. Not until he is eleven or twelve months old does he permanently acquire the capacity for sitting unsupported.

Some children *creep* before they walk—as early, perhaps, as the ninth month; with others, creeping is a later accomplishment. A strong baby generally begins trying *to stand* by the ninth or tenth month, and may be able to do so for a little by the eleventh or twelfth. The exact time at which a child *walks alone* varies considerably in different instances, fourteen or fifteen months is perhaps the average age. Some are able to do so at one year, and others not till seventeen or eighteen months. It is well to remember Dr Gee's axiom that a child "who is not idiotic or weakened by some recent acute disease, and who cannot walk at eighteen months of age, is either rickety or paralysed."[1]

Backwardness in holding up the head and in other muscular movements has a similar significance to delay in the power of walking. A healthy child takes the keenest delight in the free exercise of his muscles, and any habitual disinclination to move is a morbid sign. If a young baby is swayed up and down in his nurse's arms he shows evident signs of pleasure, and his limbs move in time with her movements. If this does not occur, and her movements arouse no answering

[1] "On Rickets," *St Bart. Hosp. Rep.*, 1868, iv., 72.

efforts on his part, there is reason to suspect the presence of an extreme degree of mental defect.

When a child who has been walking for some time "goes off his feet," this is often a sign of advancing rickets. It may, however, be due to other general disturbances. In some children, for example, it occurs from time to time along with the appearance of uric acid crystals in the urine.

An interesting difference between the muscular action of very young infants and that of adults, due apparently to an incomplete development of the motor cortex in the former, has been pointed out by Thiemich.[1] When an adult closes his fist forcibly the flexion of the fingers is accompanied by an associated dorsiflexion of the metacarpus. Similarly, a forward movement of the metacarpus goes with forcible extension of the fingers, and extension and flexion of the leg are associated, respectively, with plantar flexion and dorsiflexion of the foot. The co-ordination of these associated movements has been said to be of cortical origin. In the great majority of young infants, clenching the fist is associated with volar flexion of the metacarpus, and extension of the leg with dorsiflexion of the foot. The normal adult phenomenon only begins to be habitual in healthy children about the third or fourth month in the great majority of cases, although occasionally it is found earlier. In weakly children, even at a considerably later age (say seven months) there is dorsiflexion of the hand on seizing a pencil; but if it is pulled away from the child, his hand at once assumes the position of volar flexion characteristic of the pre-co-ordinate period of life. This phenomenon only occurs in weakly infants, and seems to indicate how easily co-ordination is exhausted in them.

Another peculiarity in the muscular system of very young babies, which should be borne in mind, is its *hypertonicity*.[2] A certain degree of this is always present in health. Sometimes, however, it is exaggerated to such an extent as to suggest a doubt as to whether the infant is not the subject of congenital spastic diplegia. It is due, apparently, to delayed development of the cortical inhibition, and has no morbid significance. It disappears entirely as the child grows older.

[1] *Zeitschr. f. klin. Med.*, 1902, xlv., 226.

[2] Hochsinger, *Wiener med. Wochenschr.*, 1900, L., No. 7, 314.

Sleep.

During the early weeks of life the infant should sleep nearly all the time that he is not being fed or washed, or having his clothes changed—perhaps 20 hours or more out of the 24. As he grows older, his need for sleep becomes gradually less, but by the end of the first year he should still be allowed from 14 to 16 hours, and during the second and third years from 12 to 14 hours in the day. One or two of these hours are to be taken in the afternoon and the rest at night. From four to five, he should have 10 to 12 hours' sleep, all at night; and from six to ten years, 10 or 11 hours. For schoolboys and schoolgirls between twelve and sixteen, 9 hours' sleep should certainly be considered the minimum allowable; and most of them will probably benefit if they can have 9½ to 10 hours regularly.[1] In the light of physiological knowledge, the idea, still held by some parents and schoolmasters, that boys are made manly by curtailing their normal amount of sleep, can only be regarded as a foolish error. Insufficient sleep is a common cause of lowered mental energy and lessened nerve force, and is very apt in delicate boys to lead to a nervous breakdown.

FIG. 20.—Atrophied Infant of 7 weeks. Natural attitude of upper limbs during sleep, and imperfect closure of eyelids.

The *attitude* the child assumes during sleep is worthy of notice. A healthy infant generally lies on his side, or rather with his body semi-prone or prone, and his head turned face downwards on the pillow. His limbs are often fully flexed, so that the knees tend to touch the abdomen and his hands are held close up to his chin (Fig. 20). As Henoch pointed out, this attitude may be regarded as reminiscent of intra-uterine life. It is apt to be altered in disease, and therefore its presence in any case is a reassuring sign.

The eyes should be closed in healthy sleep. In severe acute illness, with collapse and rapid emaciation, the eyes of the sleeping child are often partially open. This is seen also

[1] See excellent paper, *On the Hours of Sleep at Public Schools*, by T. D. Acland, M.D. (Churchill), London, 1905.

in atrophy (Fig. 20) and in extreme debility from any cause, owing probably to a lack of tone in the orbicularis muscle. Incomplete closure of the eyes during sleep, however, is not necessarily a serious symptom. In nervous, irritable children —such as grind their teeth and have night-screaming attacks— this is frequently seen after an evening party; and it merely indicates that they have had an undigestible meal or too much excitement.

The mouth should also be closed. If it is kept open habitually during sleep, this suggests the probable presence of enlarged tonsils or adenoid growths. The sudden beginning of this symptom indicates rapid swelling in the nose or at the back of the throat such as occurs in diphtheria and scarlet fever.

Young infants, after the first month or two of life, are easily disturbed; but after three or four years the child sleeps the enviably sound sleep which is so characteristic of healthy childhood, and is difficult to waken. The baby should be trained to go to sleep when left alone in bed, and not to expect to be rocked and sung to. He should, of course, always occupy a separate cot. The more sleep nervous children can be induced to take, at all periods of their lives, the better it is for them, and the more likely are they to grow out of their nervousness. The great importance of sleep to children with acute illness is not to be forgotten, and the patient must not be lightly wakened even for the purpose of feeding.

The disorders of sleep will be considered later (Chapter XXVIII.).

Speech.[1]

Development of Speech.—A baby's first cries, like his first movements, are instinctive, and have no intentional meaning. In time, however, he finds that his cry results in his being fed or otherwise attended to, and so he learns to cry when he wants anything. Later he gets to know that certain words or syllables mean certain things, and that by using them he obtains what he wants sooner than by indiscriminate crying.

By the time he is twelve months old he knows the meaning of a good many words, and there are usually one or two

[1] For the best account of speech, normal and abnormal, the reader is referred to Prof. John Wyllie's book on *The Disorders of Speech*, Edinburgh, 1894.

articulate sounds which he uses with a definite meaning. During the second year his knowledge of words increases fast, and he can frame short phrases before the end of it. The date at which different children begin to talk varies, however, greatly, and often it is impossible to tell why it does so.

During the time that they are learning to speak, normal children almost always make use of some words of their own invention; but as their powers of talking develop, these baby-words are forgotten. Similar words are often invented by imbeciles, and in them they may continue to be used during life.

Backwardness in learning to speak is a thing which naturally causes anxiety to parents. It may be explained in a number of ways—

1. It is often attributed to *tongue-tie*. This is a mistake, for while the condition may interfere slightly with sucking and possibly, as the child gets older, with the pronunciation of certain letters, it never delays speech.

2. In many cases it is a symptom of *mental defect;* and late speech always suggests the possibility of mental backwardness.

3. Not uncommonly, slowness in acquiring speech is due to *defective hearing*. This cause is apt to be overlooked, owing to the child responding at once to loud noises, although he is sufficiently deaf to have a difficulty in noticing and imitating the lesser variations of sound which make up ordinary speech.

4. More commonly, delay in speaking is due to *general backwardness in development* following severe illness, or accompanying some such weakening condition as rickets, and words come as the child gets older and stronger.

5. There are some cases, however, of children long in speaking who have normal intelligence and good hearing, and who have not been recently ill. It is impossible to tell why they do not talk sooner. The main practical point is that in such cases the prognosis is generally good; and that slowness in beginning to speak is not in itself a proof of defective intelligence.

6. We must also remember the possible occurrence of *congenital word-deafness* which is apt to be mistaken for absence of hearing (p. 30).

Aphasia may occur in children as in adults, as the result of organic brain disease, or it may be purely functional. In

the former case, it is generally, although not always, the left hemisphere that is affected; it is occasionally a prodromal symptom of tuberculous meningitis. In the latter, it is most frequently seen during recovery from one of the infectious diseases, such as enteric fever, whooping-cough, or measles, or in connection with an attack of chorea.

Nasal Speech, when it is habitual, is generally the result of enlarged tonsils or adenoids, if not of a cleft or ulcerated palate. When it sets in suddenly, it may be due to inflammatory swelling of the parts at the back of the throat, but it should always suggest examination for diphtheritic paralysis of the soft palate.

Stuttering or Stammering is sometimes met with as early as two years old in neurotic children. In these cases it is often temporary, but it is apt to return in later childhood. Persistent stuttering generally begins after the commencement of the second dentition. It is commoner in boys than in girls. In some cases, probably only in children who are predisposed, it is easily acquired by imitation.

When young children stutter, little or nothing can be done in the way of direct treatment. Attention should, however, be given to the general health, all sources of nervous excitement and irritation avoided, and singing and shouting encouraged as much as possible.

In older children great improvement follows careful training.[1] The child must attend to the way in which he speaks, and the mechanism of speech must be explained to him, so far as he is capable of understanding it. He must be taught to speak *with voice*—that is to say, with a certain musical resonance; he must also take breath frequently while speaking, so as never to speak from an empty chest. If capable of singing, he should exercise his voice in this way regularly, and he should practise for fifteen minutes at least every day, reading special sentences containing the sounds he has difficulty with, as well as ordinary poetry and prose. The child's general health must also be attended to, and special care taken that he is not being overworked at school.

Lisping is common in a temporary form in little children. It consists in a difficulty in pronouncing some of the con-

[1] Full directions will be found in Prof. Wyllie's book; also in Dr H. G. Langwill's paper on "Stammering and its Treatment by the General Practitioner," *Practitioner*, Jan. 1903.

sonants such as *s*, *k*, *th*, and *r*, which become *th*, *t*, *s* or *f*, and *w*, respectively. In some it persists for a long time, and it may be very severe. The more aggravated forms are sometimes spoken of as *Lalling*. This condition is often met with in mentally defective children. When there is no defect of hearing, according to Ashby,[1] "marked slurring or baby language in a child of five or six years of age is almost always associated with subnormal intelligence."

Idioglossia is a term given by Hadden[2] to a severe form of lalling. In it the patient habitually substitutes certain consonants which he finds easy to say (usually *t*, *d*, or *n*) for all those which he finds difficulty with. This makes his speech sound like an unknown tongue, till it comes to be analysed. The condition is commoner in boys than in girls; and the patients are often very bright children. The peculiarity shows itself when the child begins to speak; and by the time he is about four years old, if not sooner, the mother seeks advice.

The *treatment* of these speech-defects consists in training the child in articulation, as deaf-mutes are trained, by the oral method. The child is placed before the teacher, who demonstrates to him, by exaggerated movements of his own lips, tongue, and larynx, the way in which the desired sounds are produced. The child is also made to practise regularly simple exercises which contain the sounds which he has most difficulty in pronouncing. It is also particularly important that he should be separated from those who understand his peculiar jargon, so that he may be induced to take trouble to make himself intelligible.

While special treatment greatly accelerates the cure in these cases, it must be remembered that even without it, if the child's intellect is normal, there is a strong tendency to recovery. I have watched several children whose speech was badly affected in this way when they were four or five, and yet became practically normal by the time they were eight or nine, although they had had no treatment except that which the home and the Board School had supplied.

[1] *Med. Chronicle*, Oct. 1903, 1.

[2] *Journ. of Mental Science*, Jan. 1891, xxxvii., 96; see also W. S. Colman on "Impediments of Speech," *Allbutt and Rolleston's System of Medicine*, 1910, viii., 576.

CHAPTER III

ON THE TEETH

Dentition.

The Temporary Teeth.

THE temporary or milk teeth are 20 in number, and the average ages at which they appear may be given as follows:—

(1) Lower central incisors	6 to 9 months
(2) Upper central and lateral incisors	8 to 12 „
(3) Lower lateral incisors, and lower and upper first molars	12 to 14 „
(4) Lower and upper canines	16 to 22 „
(5) Lower and upper second molars	24 to 30 „

In normal children the teeth usually come in pairs—a tooth on one side cutting the gum about the same time as the corresponding one on the other. Those in the lower jaw appear a little earlier than the corresponding teeth above, except in the case of the lateral incisors. The order in which they appear in healthy infants is generally much the same, but the intervals between the cutting of the different groups of teeth often greatly vary. Irregularity in the order of their eruption and their appearance singly, instead of in pairs, is characteristic of rickets. Sometimes the first teeth appear at three or four months old; and, in rare cases, infants are born with teeth—usually the lower central incisors.

Delayed Dentition may occur in apparently perfect health, the first incisors not showing till the child is ten, twelve, or even as much as fourteen months old. Generally, however, such delay indicates disease; and any child that has no teeth at ten months should be suspected of being rickety. It is better when the teeth do not appear through the gums too early; for, when they do so, they are apt to have thin enamel, and not to last so

long as they might have done had their crowns had longer time to mature under the gum.

Symptoms of Teething.—In many cases nothing unusual is noticed in the general condition of the child while the teeth are making their way through the gum, and there is little or no local disturbance. It is, however, a matter of common observation that many babies are more or less out of sorts for a short time before a coming tooth appears, and are greatly relieved when the process is completed. The disturbance may be local or general, or both.

Local pain in the jaw is sometimes evident. A teething baby keeps his lips compressed and resents any attempt to look at his gums. He puts his fingers into his mouth as if it were uneasy, or he may screw up his face or put his hand up to his ear or jaw, as if visited by a sudden twinge of pain. A closer examination sometimes shows that the saliva is greatly increased in amount, that the gum over the coming tooth and in its neighbourhood is bright red, and the adjacent glands may be slightly swollen and tender.

The child is often flushed and feverish, whether the local disturbance is noticeable or not; and there may be restlessness, loss of sleep, and irritability. The appetite may also be lost for the time, and the bowels may become constipated, or there may be slight diarrhœa or vomiting. Often the child loses weight or ceases to gain it. Less frequently, slight temporary neuroses develop; for example, there may be a tendency to winking the eyes, a frequently recurring cough, or a decided acceleration of breathing without any pulmonary disease.

Some children have while teething a tendency to certain diseases to which they are not subject in the same degree at other times. Thus it is not an uncommon thing to find a child who, with the appearance of each new group of teeth, has an attack of diarrhœa or vomiting, or bronchitis, which resists treatment, while the teeth are in process of appearing, but rapidly recovers (under otherwise similar conditions) when they are through. Similarly, we see infants with eczema who have a marked relapse with each new group of teeth; and often an obstinate eruption will disappear spontaneously whenever all the teeth have pierced the gum.

The Place of Dentition as a Factor in the Causation of Disease.—Teething used to be regarded as a frequent cause

of serious and fatal disease. This is a dangerous belief, because there is usually associated with it the idea that, as teething is a natural process, the diseases due to it are therefore to be tolerated and not checked as they would be under other circumstances. Consequently, we have often met with children exhausted with diarrhœa which has been allowed to go on untreated for weeks because it was held to be "only from the teeth." The diagnosis of teething as the cause of any illness will always be a popular one, because it casts no blame on the parents, as exposure to cold, improper feeding, and rickets are apt to do.

A number of writers, in Germany and America chiefly, have gone to the opposite extreme, holding that dentition is a physiological process, and therefore does not cause disease —that "teething produces teeth, and nothing else."

We shall be nearer the truth if we avoid both extremes. There can be no doubt that teething is not in itself a cause of death, and that its influence in producing and predisposing to disease used to be enormously exaggerated. At the same time it is equally certain that teething, like menstruation, pregnancy, and other natural processes, is often accompanied by considerable distress both local and general, and like them may produce temporarily a tendency to disease which is not present at other times.

The effect of teething on a child's health varies with his strength, and especially with the state of his nervous system. While most children, fortunately, cut their teeth without anything but a slight passing indisposition, if even that, others who are rickety, neurotic, or otherwise weakly, may show signs of more or less severe reflex as well as local irritation. The symptoms which arise in this way may be alarming, not because they are themselves such as to threaten life, but because they often lead us to suspect the presence of some serious disease. When we remember the amount of general disturbance which may occur in children at an older and less sensitive age from phimosis or adenoids, or the presence of worms or scybala in the bowel, we can scarcely wonder that alarming symptoms are occasionally set up in babies by the irritation that accompanies dentition.

Severe Nervous Symptoms from Teething.—In very rare instances the process of teething has a profoundly disturbing

effect on the child's nervous system and severe functional neuroses are set up. These may take the form of convulsions which recur with the appearance of each succeeding tooth. Occasionally there are a series of nervous symptoms. There may, for example, be violent, apparently causeless, screaming, intense photophobia like that from a corneal ulcer (although the eyes are normal), obstinate insomnia, giddiness, head-retraction or nervous vomiting. The symptoms set in suddenly when a tooth, or set of teeth, is appearing; they often last for weeks, and pass off abruptly when the teething is over for the time; and they usually recur when the next set of teeth are being cut. When such symptoms occur, there is usually a noticeable absence of salivation. Cases of this type are very seldom met with, and the symptoms are apt to be attributed to much more serious causes. They require special treatment.

Diagnosis of Symptoms due to Teething.—It is easy to ascertain whether teething is proceeding or not, but often difficult to make sure of the part, if any, which it plays in producing such symptoms as are present. For example, a case of simple bronchitis may be mistaken for one of pneumonia on account of a high temperature and rapidity of breathing which are really attributable to dentition. In such a case, a careful consideration of the physical signs, and the absence of real dyspnœa will help in deciding the diagnosis. Again, children who are suffering from dyspepsia, and teething at the same time, may be drowsy, irritable, and feverish; they may even have head-retraction and they often have vomiting, so that a mistaken diagnosis of early meningitis is possible. The absence of cerebral breathing and of a slow, contracted, and irregular pulse, of obstinate constipation, or of a retracted abdomen is in favour of the less serious condition, and should incline us to suspend our judgment until further symptoms appear. A knowledge of the physiognomy of cerebral disease will be found of practical value; and a timely dose of castor oil may remove diagnostic difficulties to a surprising degree.

We should not, therefore, be ashamed of diagnosing teething as the cause of certain morbid phenomena in infants. This diagnosis, however (like that of hysteria in older patients), should never be made until all other causes of the symptoms

have been carefully excluded, and we should not be satisfied with it until the child is well.

Treatment.—The restlessness, wakefulness, and irritability of teething children is often greatly relieved by the administration of a sedative such as antipyrine (1 to 2 grs.), phenacetin (1 gr.), or bromide of potash or soda (2 to 4 grs.). Preparations of opium, including the so-called "Soothing Syrups," should never be used for this purpose in ordinary cases of teething. In the case of severe nervous symptoms, however, such as the violent screaming attacks referred to above, the administration of large and, if necessary, increasing doses of opium form the best treatment. When the teeth appear in these cases there is no difficulty in stopping the drug.[1] As already mentioned, an aperient such as castor oil frequently produces a striking improvement in the symptoms. Diseases which occur during dentition should be treated as at other times, and the fact that teething is proceeding affords no reason why treatment should be delayed or considered unnecessary.

Lancing the gums was at one time advised in all cases of obscure disease occurring at the age of dentition. It is now known that such a practice is not only unnecessary but probably hurtful in all but a few cases. When serious disease is present, it is extremely doubtful whether lancing the gums can ever favourably influence its course. In cases, however, in which the gum is swollen, red, and tense over a coming tooth, and the child is suffering local pain, or showing signs of reflex nervous disturbance, there can be no doubt that lancing of the inflamed gum often affords immediate relief, and it can do no harm.

The Permanent Teeth.

The permanent teeth number 32. The order and time of their appearance are usually given as follows:—

First Molars	6 years
Incisors	7 to 8 „
Premolars	10 „ 11 „
Canines	10 „ 11 „
Second Molars	12 „ 13 „
Third Molars (wisdom teeth)	17 „ 25 „

[1] Thomson, *Edin. Med. Journ.*, March 1917, 203.

The first molars appear behind the second temporary molars, while the permanent incisors, canines, and bicuspids take the places of the temporary incisors, canines, and molars. The eruption of the permanent teeth is not a usual source of irritation either general or local in childhood, though the wisdom teeth, especially those of the lower jaw, may cause a surprising amount of distress when they are appearing. Delay in the appearance of the permanent teeth is one of the symptoms of sporadic cretinism, and is a useful help in the diagnosis of slight and atypical cases of that disease. In sporadic cretins who have been on thyroid treatment since infancy, the permanent teeth appear unusually early.

Caries of the Teeth.

Among civilised peoples, no other single disease of the body is nearly so common as dental caries; almost everyone has it. It usually begins in early life, and recent observations on school children show that it is rare, nowadays, to find one of them in twenty with perfectly healthy teeth. We are told by dental authorities[1] that this state of things prevails, with only slight differences, all over Great Britain, indeed in all civilised countries, and in every rank of society, and that it is getting steadily worse. Among uncivilised races, dental caries is much less common; its prevalence among them varies from 20·8 per cent. among some negroes to only 1·4 per cent. among the Esquimaux.

Since the extraordinarily wide prevalence of the disease among us has long been known, the wonder is that our profession has shown, hitherto, so little active interest in searching out its causation and learning how to prevent it. It might be thought that this neglect was due to the ailment being comparatively harmless, but this is very far from being the case. Carious teeth not only lead to toothache, neuralgia, and disfigurement—not to speak of dentists' bills—but they are also occasionally a source of greater evils. For, if

[1] The author is much indebted to the writings of Dr J. Sim Wallace, *The Prevention of Dental Caries*, 2nd. ed., London, 1912, and others; to H. P. Pickerill, *The Prevention of Dental Caries and Oral Sepsis*, London, 1912; and to J. H. Gibbs, *Edin. Med. Journ.*, June 1917, 433. He has also to thank Dr Gibbs for valuable advice in writing this chapter.

the disease is extensive, it frequently interferes with mastication to such an extent that the child suffers severely from chronic indigestion and consequent malnutrition; and, as we all know, even a single diseased tooth that has been overlooked may set up chronic septic absorption and keep a child anæmic and cachectic for years. It would almost seem as if we had given up hope of ever learning how the disease could be prevented, and were satisfied that the best that can be done for it is to soothe its pains, patch up and conceal its ravages, and treat its complications. We cannot say that our dental brethren have, until recently, done very much to correct our mistakes in this matter. Within the last few years, however, certain aspects of the etiology of dental decay and the ways in which we can aid Nature in preventing it, have been thoroughly investigated by able members of the dental profession; and it is certainly time that we recognised and availed ourselves of their valuable contribution to preventive medicine.

We find that these investigators do not regard dental caries as one of the inevitable evils that humanity is heir to. On the contrary, they are convinced that it is not hereditary, but acquired; and they give it as their opinion that *few diseases are so easily and certainly preventible, provided simple and rational precautions are taken.* They would have us believe that caries of the teeth is a quite unnecessary malady of civilisation; and that we go on giving it to our children simply because we will not stop feeding them in foolish and unphysiological ways that frustrate Nature's plans for keeping the teeth healthy. Much of the evidence brought forward in support of these views is convincing, and, although the dentists seem, as yet, to have made too little of the part played in the causation of caries by malnutrition and general hypoplasia of the teeth from unsuitable food in infancy, their work deserves more attention than it has yet had from the medical profession.

Let us then consider briefly why and how our teeth decay, in what way Nature tries to prevent this happening, and how we can best help her to do so.

The Causes of Dental Caries.

The chief elements in the etiology of dental caries are two in number:—(1) *Hypoplasia of the structure of the teeth* with defective formation of the enamel, which is due to lowering of the general nutrition, and which renders them abnormally vulnerable; and (2) *bacterial action on the dentine.* This is rendered possible by removal of the protecting enamel by acids formed in the mouth by other micro-organisms. These act on any particles of carbohydrate food that have lodged there owing to local defects or unphysiological ways of feeding.

(1) **Dental Hypoplasia.**—During the second dentition, *local* hypoplasia of portions of certain of the teeth is observed in some cases of congenital syphilis (p. 55); and, in other cases, transverse bands of defective enamel are found which correspond to periods of severe feverish or other illness which occurred at the time when that particular level of enamel was forming under the gum.

It has long been known in a general way that poor health of any kind may favour the occurrence of dental caries, and many invalid children suffer from it to an especially severe degree. A rapid onset of decay during convalescence from long-standing debilitating disease has also often been observed. Our knowledge of the *generalised* hypoplasia of the enamel which renders the teeth more prone to decay has now, however, been placed on a more scientific basis by Mrs Mellanby's recent experimental work on this form of defective development.[1] Her conclusions are to the effect that this hypoplasia is largely caused by defects in feeding during the first two years of life, and that the element in the diet which is lacking is of the nature of an "accessory food factor" (see Appendix D.). Mrs Mellanby's observations also seem to indicate that the missing vitamine is probably identical with the "Fat Soluble A" which E. Mellanby has shown to be the main cause of rickets (p. 222). Puppies fed on such foods as cod-liver oil and butter, which contain plenty of this substance, were found always to develop teeth with sound enamel; while those kept on diets otherwise adequate, but deficient in this vitamine, showed partial absence or marked defect of the enamel with a very

[1] *Lancet*, 1918, ii., 767.

low calcium content. It was also found that their teeth had a tendency to irregularity in position and to overlapping.

Another recent observation which is of interest in this connection has been made by S. S. Zilva and E. M. Wells.[1] They find that guinea-pigs and monkeys, which have had even the mildest degree of scurvy, invariably show well-marked microscopic changes in their teeth. In bad cases the teeth become loosened by gradual absorption of the cement membrane of the alveolar sockets leaving the portion below the neck of the tooth exposed. In addition the teeth show all the appearance of a senile change. Although it has not been proved that similar changes occur in babies with infantile scurvy it seems probable that this may be so.

(2) **Bacterial Action.**—In more ways than one, decay of the teeth is a micro-organismal disease. The caries itself is the work of pathogenic bacteria which attack the dentine and adjacent structures. These organisms, however, cannot get into the teeth unless the protecting enamel has first been decalcified and softened; and this preparatory process is almost always due to acids which are formed in the mouth by the action of other bacteria on the remains of carbohydrate food left adhering to the teeth. This process is predisposed to by various things—(*a*) by abnormalities of structure and position of the teeth; (*b*) by functional defects connected with salivation and mastication; and (*c*) especially by faulty food and ways of feeding.

(*a*) *Abnormalities of Structure and Position of the Teeth.*—When the teeth are well formed, regularly placed in the jaws, and as vigorously used as they ought to be, there is little tendency for fragments of food to be left adhering to them; but such matters are sure to gather and ferment when there are holes or corners anywhere. These cavities may consist of abnormal pits and fissures which have developed in the teeth themselves owing to some such weakening disease as an infectious fever, dyspepsia, or whooping cough having occurred at the time when the enamel at that level on the tooth was being formed. Much more frequently, however, the traps which catch and harbour the starchy and saccharine particles consist of crevices formed between adjoining teeth

[1] *Proc. Roy. Soc. B.*, 1919, xc.; also Editorial, *Lancet*, 28th June 1919, 1129.

which are irregularly placed and crowded together. This irregularity and crowding arise often from defective growth of the jaws, which again is mainly due, in all probability, to too little use at an earlier period of life. Deficient development of the jaws from want of exercise may begin very early, for we find that they grow less normally in bottle-fed babies than in those on the breast; and the same thing happens in older children when they are fed only on soft pappy foods and get no tough and fibrous materials to practise them in the art of chewing. Defective growth of the jaws may also be one of the results of rickets or of naso-pharyngeal obstruction from adenoids; and it may also be produced by the injudicious and premature extraction of temporary teeth. As we have already seen, the teeth of children who have suffered from severe chronic illness — especially rickets — in infancy are especially prone to decay, and the same is true of teeth which have been cut prematurely before the enamel has been properly formed.

(*b*) *Functional Defects of Salivation and Mastication.*—Anything which lessens the amount, or changes the normal composition of the saliva is apt to increase the liability of the teeth to decay; and whatever discourages the free play of the jaws in mastication does likewise. A painful state of the mouth from bad teeth or any other cause has this effect.

(*c*) *Faulty Food and Ways of Feeding.*—Another very important factor in the causation of dental caries is the habitual feeding of young children on soft food with too much sugar in it and too little sapid substances of other kinds. The giving of too little fruit, or fruit at wrong times, of too much farinaceous and too little animal food are probably all dietetic errors which are bad for the teeth.

Nature's Provision for keeping the Teeth Healthy.

All the various fluids by which the different tissues of the body are naturally bathed have a powerful effect in protecting them from morbid influences. The saliva is no exception to this rule; and its composition and other characters make it, under normal conditions, a potent preventive of dental caries. Its diastatic ferment is not only helpful in

the digestion of the starchy food that is swallowed, but does at least as much service to the body by dextrinising those fragments which are clogging the teeth, so that they are easily washed away in the processes of chewing and deglutition. Its alkaline reaction is a constant check on the acidity which is produced by the fermentation of carbohydrate debris.

Any food that is taken into the mouth stimulates the flow of the saliva; and starchy food, especially if it has a slightly acid taste, calls forth a form of saliva which is specially rich in ptyalin. Sugar, in any quantity, has an opposite effect and tends to lessen the amount of ptyalin.

The saliva cannot exert its wholesome properties to the full unless it is driven into all the corners of the mouth by prolonged and vigorous chewing.

Some of the numerous harmless micro-organisms which are always present in the mouth, are believed to play a useful part in its hygiene by digesting and liquefying albuminous shreds and particles.

Diet in Infancy and Childhood in relation to the Prevention of Caries.—The solution of the problem of the prevention of dental decay lies then largely in the selection of a natural diet, and in proper habits of eating. Before the appearance of the teeth, the chief thing, of course, is that the baby should be on the breast, and, if this is impossible, that he should be fed on a diet which will not cause rickets, and in a manner as nearly as possible like breast-feeding.

When the teeth begin to appear, there are two other things that are important. The first of these concerns the consistence of the meal. When farinaceous food is given, it should not be mixed with the milk in a pulpy and relatively tasteless mass, but a certain amount of it should be taken dry in the form of hard toast or baked bread,[1] with or without a little salt butter. The meal of boiled bread and milk, sweetened with sugar, that is often given, is an ideally bad food for little children, and is almost certain to be gulped down without mastication or insalivation. When the food is given dry, it has much more taste, and this promotes its mastication and also increases the

[1] To be properly baked the bread should be cut into slices and put into an oven that is hot enough to make it, through and through, of a yellow biscuit colour in about an hour's time. Prepared in this way it remains crisp and palatable for a long time.

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secretion of the gastric juice. It also excites a free flow of saliva, which leads to the starchy particles about the teeth being dissolved and washed down. Even before the appearance of the molars, a little food of this kind may often be given with advantage, though it is, of course, only when they are through the gum that thorough mastication is possible.

The other important point is that the infant's food should not be unnaturally sweetened. Children fed on tasteless pap usually have a craving for cane sugar, and it is a common error to suppose that it is therefore a necessary and natural thing to give them. This is far from being the fact; indeed, the case against sugar being used in diet as freely as it is at present is very strong. Cane-sugar, we must remember, is a comparatively recent addition to ordinary food, in the world's history. In old days it was quite unknown; even in Pepys' time it was still an expensive luxury. A few hundred years ago the children of our own and other races, whose teeth are known to have been better than ours are now, were brought up altogether without it. Again, while it is true that sugar is an important element in some of the best natural foods we have—such as fresh fruit—it is scarcely anywhere found in nature (except in honey) without being in combination with acid salts, and so mixed with fibrous tissue that the mouth and jaws are well exercised in the process of obtaining it. To give it freely in the form of jam, chocolate, and sweets is obviously unnatural. When given in these forms, in any quantity, it interferes with the proper amount and composition of the saliva, lessens the child's power of digesting his necessary starchy food, and spoils his appetite for the fatty foods which are so important for his growth and development. It is certainly bad for the teeth, and one can scarcely regard it as otherwise than foolish to suppose that a food which is detrimental to one important part of the digestive tract is likely to be very good for other parts of it.

We may sum up, then, by saying that while there can be no doubt that sugar is a welcome addition to children's diet, and while, in moderation and with sensible safeguards, it is harmless and useful as well as pleasant, its use must be limited and regulated by common-sense. Given carelessly, and in huge excess, as it often is in this country, it is a real evil, and a fruitful source not only of dental caries but also of serious indigestion.

Not only must the child's meals contain food in proper forms, but they should also be arranged as far as possible physiologically. That is to say they should not end with sticky carbohydrates which are likely to lodge about the teeth, or with sweets. The dentists tell us that the ideal thing is that milk puddings, bread and jam, and all sugary articles of diet should if possible be followed by some form of fresh fruit, and that the best of all fruits for the teeth are ripe apples. Their slight acidity promotes a free flow of saliva of high alkalinity and diastatic power, and in chewing them the teeth are naturally and efficiently scoured. When the meal cannot be ended with fruit, which must very often happen, it is practically sufficient if the mouth is well rinsed out with water, and it is even better if a mouth-wash of an acid reaction (Appendix I., Form. 1 and 2) can be used to promote a free secretion of alkaline saliva.

The common habit of giving a child chocolate or other sweets at the end of any meal is altogether bad, unless the mouth is washed out after. The worst thing that can be done in this way, however, is to encourage the fermentation in the mouth by giving the child a sweet after supper when he is going to sleep; and "a tiny piece of chocolate" is as harmful in this respect as a bagful of sweets.

The subject of the child's diet is further dealt with in Chapter VIII.

Artificial Methods of Cleansing the Teeth.

The Tooth-Brush.—The real use of the tooth-brush is to keep the teeth white and to remove discoloration. It is less necessary and also less efficacious for this purpose in children than in adults. It is very difficult to use a tooth-brush so as to be an efficient preventive of caries; for, however carefully it is manipulated, it never removes all the fermenting matter from the teeth, so that it does not really cleanse them as efficiently as rinsing out the mouth or as the vigorous chewing of suitable food.

The tooth-brush must be as small as possible, with fairly stiff bristles, and it should not be used too vigorously for fear of injuring the margins of the gums. When not being used, it should be kept in a weak antiseptic solution, or else it should be frequently washed with soap and water. Plain water, and no

dentifrice, should be used with it. Before and after its use, it is a good plan to rinse the mouth out with an acidulated mouth-wash.

Tooth-Powders.—Like tooth-brushes, tooth-powders are more useful for cosmetic purposes than for preventing decay. If used at all, they must not be too gritty in consistence or they may damage the enamel. If they are alkaline, they neutralise the acids of fermentation for the time being; but they also discourage the secretion of the saliva and lower its cleansing properties, so that their use is really inadvisable.

Antiseptics.—When the part played by bacteria in the production of caries was first demonstrated by Miller, much was expected from the use of antiseptics. In practice, however, their effect has proved disappointing. The micro-organisms are far too safely imbedded in the carbohydrate debris to be freely reached by them, unless the antiseptics are used in unpleasantly strong solutions and retained for an impracticably long time in the mouth. They also all tend to retard the liquefaction of albuminous debris about the teeth. When a wound has been inflicted, as by the extraction of a tooth, the case is somewhat different, and under these circumstances an antiseptic mouth-wash is beneficial.

Mouth-Washes.—The simplest and most natural plan for keeping the mouth clean is to rinse it out with plain water after each meal. The use of this simple proceeding is most efficacious in preventing caries; and, if it is done regularly and thoroughly, it is probably all that is necessary to keep the teeth healthy, if they are normal in form and not overcrowded. Dentists, however, tell us that it is best to use, instead of plain water, a mouth-wash containing a vegetable acid salt (such as acid tartrate of potash) and an aromatic flavouring agent. Such mouth-washes (Appendix I., Form. 1 and 2) strongly stimulate the secretion of normal saliva and thus promote the normal cleansing of the teeth.

The best and only thoroughly satisfactory method of keeping the teeth clean and preventing caries is therefore the natural and physiological one of the vigorous chewing of suitable food. And this can be usefully supplemented by the regular washing-out of the mouth, morning and evening and after each meal, with water or with a suitable mouth-wash. It is especially important that this should be done thoroughly before the

child goes to bed, as it is during the night that the bacterial growth is most active. It is said that, when reasonable habits of mastication are practised, it takes twenty-four hours for the mucus and debris to reaccumulate to a harmful extent round the teeth.

There are some medicines the taking of which is bad for the teeth—chiefly those containing a mineral acid, and some preparations of iron. Taking them through a glass tube does not protect the teeth efficiently; and the best thing to do is to see that the child washes the mouth out freely each time after the medicine is taken.

Toothache.—The occurrence of toothache due to dental caries is evidence of neglect; for, by the time the pain begins, the decay is often so far advanced that the tooth is past saving. It is most important for successful treatment that the disease should be dealt with early. For this reason a careful watch should be kept for its beginning, and every child from the second year should have his teeth examined by a dentist twice a year.

The treatment of toothache is, of course, a matter for the dentist; but a few simple measures may be mentioned which are sometimes useful in relieving the pain until more skilled treatment can be obtained. One of the first of these that should be tried consists in filling the mouth with a hot solution of bicarbonate of soda; this often affords considerable relief in the pain of dental caries. When the pain comes from a commencing gumboil it may be benefited by irrigation with hot saline solution; but moist heat should never be applied to the outside of the jaw in such cases. When the pain originates in an accessible cavity, a fragment of cotton wool dipped in clove oil and inserted into it often stops the aching for the time. A dose of antipyrine, aspirin, or other similar analgesic is sometimes useful in dulling the sensation, and a small dose of Gregory's powder is also often followed by relief.

Dental Abnormalities.

Most of the abnormalities of form of the teeth, and of their number and position, are only of interest to the dental surgeon and pathologist. There are, however, certain changes in their form which have a wider significance as giving information relating to the general health or past history of the child.

Traces of Grinding the Teeth.—We often find indications that a child grinds his teeth during sleep. It is shown by extreme flattening of the tips of those teeth which are most prominent, as if a file had been used upon them; and the canines are those most strikingly affected. This appearance may arise in children from mere chewing but only to a slight extent; it is only seen in a severe degree when there has been habitual grinding of the teeth for a long time. It may therefore be looked upon as a physical sign of nervous irritation. The irritation which it indicates is generally of the comparatively harmless sort which results reflexly from injudicious feeding, or the presence of worms, or from too much excitement in a nervous but otherwise healthy child. If we are told that a child who has severely ground teeth sleeps quietly and well, we may suspect, as Dr Warner says, "that it is the nurse who sleeps soundly, and not the child."

Defects in the Calcification of the Enamel.—These are often seen in the permanent and more rarely in the temporary teeth, forming a discoloured transverse furrow which passes across the front of the incisors and canines, and often also implicates the crowns of the molars. This, as we have already seen, shows that at the period of the child's life at which the calcification of that part of the enamel was proceeding, something occurred to check its progress. The condition is analogous to the grooving of the finger nails which we observe after fevers. A groove across the middle of the central permanent incisors may be due to an acute illness which took place in the third or fourth year. Many grooves of this kind, however, occur, for which no corresponding history of illness can be obtained.

Mercurial Teeth.—This is the name given by Sir Jonathan Hutchinson[1] to an abnormality of the permanent teeth due to interference with the development of the enamel. In his opinion this may arise from simple stomatitis, as well as from that which follows the administration of mercury. The teeth are rugged, pitted, or dirty on the surface. The first molars, incisors, and canines are the teeth which show the condition most frequently; the premolars escape. The effect of the stomatitis is usually confined to an interference with the development of the enamel, and rarely of the dentine. It

[1] *Illustrations of Clinical Surgery*, 1878, i., 53.

does not cause arrest of development of the tooth as a whole in the way that congenital syphilis does.

Congenital Syphilitic or Hutchinson's Teeth.—(Figs. 21 to 23). This variety of dental abnormality is important, because

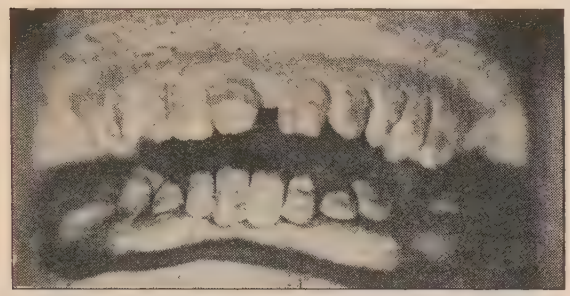


FIG. 21. — Congenital Syphilitic Teeth, Upper Central Incisors. Girl of 9 years. (Dr R. J. Mackessock's case.)

as Hutchinson says, "It is, if taken alone, by far the most valuable of the signs by which we recognise in adolescents the effect of inherited syphilis." The characteristics of these teeth are not sufficiently known, and abnormal and peculiar

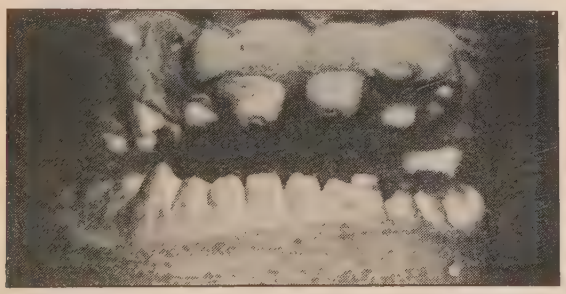


FIG. 22.—Congenital Syphilitic Teeth, Upper Central Incisors. Boy of 10 years.

teeth of other kinds are often erroneously regarded as proofs of congenital syphilis. The main points about "Hutchinson's Teeth," are as follows :—

1. It is always *the permanent teeth* which are affected thus. The temporary teeth in syphilitic infants present no special peculiarities of form.

2. The only teeth which afford incontestable evidence of congenital syphilis are the *upper central incisors* and the *first molars*. The other incisors and the canines often supply corroborative evidence, but they are never to be trusted to alone.

3. The characteristic peculiarities which distinguish these central incisors are as follows:—They are *dwarfed*, being too short and too narrow; and sometimes the portion of the upper

FIG. 23.—Congenital Syphilitic Teeth, Upper Jaw. Showing pegged and rounded central incisors and domed molars. Girl of 10 years. (Dr R. J. Mackessock's case.)

jaw from which they grow is also arrested in growth.. They often *stand somewhat apart* and slope towards one another. They are unusually *rounded* on section; they are "*pegged*" (that is to say, the teeth are broader near the gum than at their free edge); and they are *notched*. The notch is usually shallow and the dentine is exposed at the bottom of it. It is formed by the breaking away of the imperfectly developed central portion of the edge. The teeth are generally *not of a good colour*, and they are *abnormally soft*, so that by the time the patient is twenty, they may be ground down like those of an old man.

The first molars are next in diagnostic importance to the upper central incisors. When characteristic they are spoken of as "dome-topped" (Fig. 23). Their sides slope towards the centre over which the enamel is defective. As might be expected, syphilitic teeth not infrequently present the characteristics of mercurial teeth in addition to their own.

CHAPTER IV

ON THE EXAMINATION OF THE HEAD, NECK, BACK, AND LIMBS

The Head.

THE size, shape, and ossification of the cranium, including the condition of the fontanelle and sutures, are the main points to which attention should be directed in examining the head.

Size.—At birth, the circumference of the infant's head is on an average 13 to 13¾ inches; and it grows so rapidly that

FIG. 24.—Microcephalus. Girl of 4¾ months.

FIG. 25.—Microcephalus. Girl of 2 years.

it usually gains 3 inches in the first six months, and by the end of the first year measures about 18 inches. During the second year the circumference increases by about 1 inch. At five years the average child's head measures from 20 to 20½, and at ten about 21 inches.

The size of the head may vary considerably within normal limits, and sometimes children are seen with curiously long or large heads, whose intellectual development is not abnormal.

FIGS. 26 and 27.—Girl of 4 months.

FIGS. 28 and 29.—Boy of 18 months.

FIGS. 30 and 31.—Boy of 12 years.

As a general rule, where the head is unusually small or large from causes which interfere with the health of the brain, some characteristic change in its shape will also be found. It is only when the variations in size are great that they are to be considered really morbid. In a large proportion of mentally defective children the head is below the average in size, and this is an important point in the diagnosis and prognosis.

Shape.—Asymmetry of the cranium is frequently seen in infants who are otherwise normal or merely rickety, and the condition is of no practical importance.

Microcephalic crania (Figs. 24 and 25) are recognised not only by their small size, but also by their peculiar shape. The forehead is very narrow and receding, the vertex some-

FIG. 32.—Square head of Rickets. Boy of 2½ years.

what pointed, and the occiput flat. The fontanelle is either closed at birth or closes prematurely.

In *hydrocephalus* (Figs. 26 to 31) the head is enlarged both antero-posteriorly and from side to side, and its shape is more globular than in any other condition. In doubtful cases we are often helped in the diagnosis by observing a somewhat downward direction of the eyes, which is shown by the high level at which the lower lid crosses the eyeball and the unusual amount of sclerotic seen above the iris. The large and bulging fontanelle, which is often patent up to four or five years of age, is also a striking feature, as well as the defective ossification of the edges of the cranial bones resulting from internal pressure. When the head has recently enlarged, the superficial veins of the scalp are usually dilated.

The chief characteristic of the ordinary *rickety cranium* is its squareness (Figs. 32 and 33), the top of the head, the sides, and the face all tending to be flatter than usual. The head

itself is usually rather larger than it should be for the child's age, and a good deal too large for the size of his body.

In many cases of rickets the form of the head becomes further changed by the outgrowth on its surface of osteophytic nodes, or bosses, as they are usually called. These are bony thickenings of the outer table of the skull, and they sometimes grow until the bone is fully half an inch in thickness. When they are large, the skull is sometimes described as

FIG. 33.—Square head of Rickets.
Boy of 3 years.

natiform, and the fitness of this name can be readily appreciated by looking at Figs. 34 to 39. These represent the appearance of the head at different ages in two boys, the first of whom was certainly, and the other probably, syphilitic as well as rickety. When both rickets and congenital syphilis are present, bossing is commoner, and also greater in degree, than in simple rickets. An extreme degree of bossing is very often associated with great enlargement of the spleen in infancy, and with a stunted growth of the whole body in later life.

FIG. 34.—J. S., at 12 months.

FIG. 37.—J. P., at 12 months.

FIG. 35.—J. S., at 2 years.

FIG. 38.—J. P., at 2 years.

FIG. 36.—J. S., at 11 years.

FIG. 39.—J. P., at 11 years.

Peculiar and characteristic deformities of the cranium are found in osteogenesis imperfecta (p. 717), and in the variety of fragilitas ossium which is associated with blue sclerotics and otosclerosis (p. 721).

Soft, often asymmetrical swellings on the surface of the cranial bones are sometimes formed by abscesses over *tuberculous bone disease* (Fig. 40); similar swellings may, less

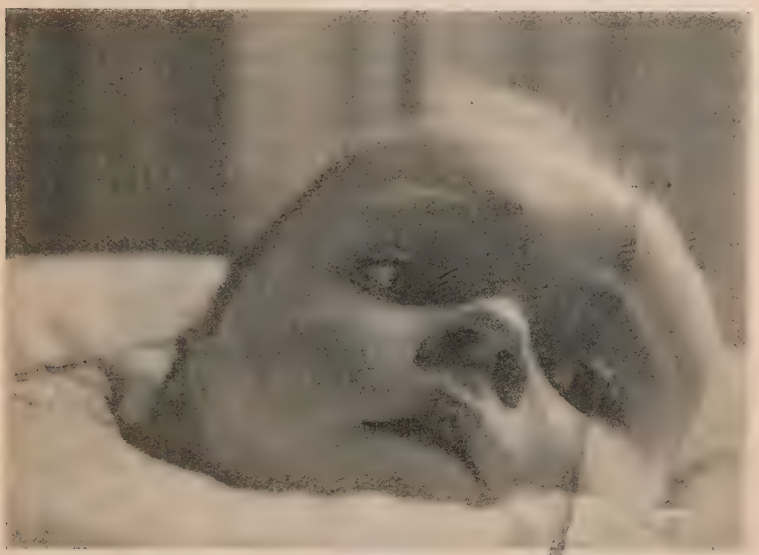


FIG. 40.—Tuberculous Disease of the Frontal Bone.

commonly, be met with in congenital syphilis, and, rarely, in sarcoma.

The Ossification.—This is investigated by palpating the anterior fontanelle, the sutures, and the parietal and occipital regions for craniotabes.

The Fontanelle.[1]—In the cranium of the new-born child there are six fontanelles situated at the various corners of the parietal bones. Except in some cases of rickets and hydrocephalus, the posterior and the four lateral fontanelles are usually closed within a few weeks of birth. The anterior, therefore, is the only one which is of much clinical importance, and it is generally spoken of as "the fontanelle." The

[1] See C. Hochsinger, "Studien über die klinischen Verhältnisse der Stirnfontanelle, *Wiener Klinik*, July, August, 1892.

characteristics of the normal fontanelle which have to be noticed are its shape, edges, tension, level, pulsation, and size.

In *shape* the fontanelle is somewhat rhomboid with slightly curved borders which are convex inwards. Its bony *edges* are felt distinctly at their junction with the membrane, and are somewhat rounded. Should they be so thin and yielding that there is difficulty in determining where the bone stops and the membrane begins, this indicates cranial rickets or long-continued increase of the intra-cranial pressure, or both.

The fontanelle, like the eyeball, has a normal *tension*. The membrane is stretched somewhat tightly between the bony edges, and is about the same level as they are. Any change in the intra-cranial pressure affects the tension and *level* of the fontanelle, so that it either bulges out above that of

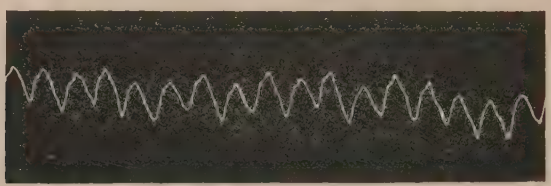


FIG. 41.—Tracing of Normal Fontanelle Pulse from an infant of 4 months. Dudgeon's sphygmograph (Dr H. O. Nicholson).

the surrounding bones or becomes depressed and hollowed out. There is normally a rhythmic *pulsation* of the fontanelle transmitted from the intra-cranial arteries. When investigated by the sphygmograph,[1] the tracing of this pulsation is found to have an anacrotic character, and it also shows slight irregularities due to the respiratory movements (Fig. 41). The pulsation is increased if the tension is moderately raised, but ceases if it is either greatly raised or lowered to any considerable extent. If the ear or the end of a stethoscope is applied over the fontanelle, a systolic *murmur* can often be heard. This murmur has been much studied, from a clinical point of view, but so far as our present knowledge goes, it is of no diagnostic value.

The *size* of the fontanelle is the last point. It normally closes in the second year—generally between the fifteenth

[1] H. O. Nicholson, art. "Pulse," *Encyclopædia Medica*, x., 208; R. Hutchison and George Elder, *Edin. Hosp. Rep.*, 1895, iii., 268.

and eighteenth months. It generally increases in size for several months after birth and then diminishes. If the area amounts to a square inch at eight months old, we may regard it as too large.

The conditions of the fontanelle which are most important from a clinical point of view are as follows:—

1. *Alterations in size and date of closure.*

(*a*) Delay in the normal closure of the fontanelle and its enlargement are caused by various morbid processes. It may be due to hydrocephalus or any other morbid condition which increases the cranial contents. Much more commonly, it is caused by rickets—so that if the fontanelle is large at eighteen months, or open at all after the second year, rickets should always be suspected. Delay in closure is also common in mongolism, while in untreated cretins and in cases of cleido-cranial dysostosis the fontanelle generally shows no tendency to close in infancy, and may be found widely open in adults of thirty or forty years old. Simple malnutrition does not seem to delay the closing of the fontanelle.

(*b*) Premature closure is a valuable early sign of microcephalus.

2. *Alterations in the tension and level of the fontanelle.*—These are extremely important owing to the information they supply as to the intra-cranial tension; thus—

(*a*) Slight increase of its tension with some bulging outwards is caused by cerebral hyperæmia, active or passive. We see it therefore in acute feverish conditions, in whooping-cough or chronic bronchitis, and always, temporarily, when the child coughs or cries.

(*b*) Great tension with marked bulging indicates a considerable increase in the contents of the skull, such as is found in effusion into the ventricles or in cerebral tumour. It is seen also in new-born children when there has been an extensive intra-cranial hæmorrhage.

(*c*) Abnormal depression with diminished tension of the membrane is associated with lowering of the vital powers. It is met with in acute cases of diarrhœa, with rapid loss of fluid. It is very characteristic of cases of atrophy (decomposition), of food intoxication (Chapter IX.), and of wasting from any cause. Recovery of the normal tension in such cases is a reassuring sign of improvement.

In cases of diarrhœa with cerebral symptoms ("hydrocephaloid") the presence of this sign is useful in helping to distinguish the condition from real hydrocephalus (meningitis). When it is present to a marked degree in diarrhœa it is an urgent indication for stopping milk, administering saline infusions, and applying external warmth.

(*d*) A condition of normal tension of the fontanelle, along with cerebral or meningeal symptoms, is often met with and is of diagnostic importance. It occurs, for example, in some cases of "cerebral" pneumonia (that is, cases of pneumonia with prominent cerebral symptoms, such as delirium, head-retraction, and fits), and its presence is sometimes of value in differentiating these from cases of pneumonia complicated by meningitis. Generally speaking, it may be said that in feverish illnesses in young babies cerebral symptoms do not indicate the presence of intra-cranial disease unless they are accompanied by a bulging fontanelle. We occasionally, however, meet with exceptions to this rule.

The Sutures.—The main sutures should also be felt. Any gaping of them with thinning of their bony margins has the same significance as enlargement of the fontanelle.

Craniotabes.—Craniotabes is the name given to thinning of the cranial bones. In its slightest form it causes a softening of their edges, with widening of the fontanelles and sutures, such as has been already referred to. When it is present to a severe degree we find little rounded areas of thinned bone at some distance from the sutures. These yield before the point of the finger, and give a slight sensation of crackling like that of parchment. They are found most frequently on the parietal and occipital bones near the lambdoidal suture, and sometimes the absorption of bone goes so far that there is nothing but a little window of membrane left at each of the affected areas.

In osteogenesis imperfecta and some other obscure conditions considerable areas of the cranial bones are membranous at birth, and remain so for months. Craniotabes is sometimes due to chronic hydrocephalus; in the great majority of instances, however, it is merely a manifestation of rickets, and it is generally found to some degree in any young baby who has well-developed rachitic symptoms. The most severe degrees of this condition, however, are rarely found except in children who are syphilitic as well as rickety.

The Neck.

In examining the neck we have to look out for any restriction of its natural movements, for tumours in the sterno-mastoid, if the patient is a young baby, and for enlargement of the lymphatic glands.

Rigidity of the Neck in babies and its **retraction** represent two degrees of a common and important symptom which will be referred to later in considering the diagnosis of nervous disease (Chapter XXVII.).

In older children it occurs in an acute and temporary form as a manifestation of lithæmia or rheumatism, and as a more permanent deformity in the wryneck which often follows sternomastoid tumour, in rheumatoid arthritis, and in cervical caries. A sudden very painful rigidity of the neck is sometimes caused in cases of septic sore throat by acute inflammation of the deep lymphatic glands which lie in close contact with the cervical vertebræ.

Enlargement of the Cervical Lymphatic Glands is always a matter of interest, and it is important to notice which group of glands is affected. The area of skin or mucous membrane with which these are connected should also be examined, so as to discover, if possible, whether there is any local source of irritation present which requires treatment.

Enlargement of the submaxillary group of glands, if there is no visible cause for it on the face, generally indicates some irritation from the gums or teeth; and in the same way, sores on the chin, the lower lip, or the front of the tongue give rise to enlargement of the suprahyoid gland. If a number of superficial enlarged glands are found along the posterior border of the sternomastoid muscle, there probably is, or has recently been, some irritation in connection with the scalp, such as that produced by pediculi. Swelling of the posterior cervical glands is also often the first symptom of rubella; and it may sometimes be seen in cases of erysipelas of the scalp, before the rash appears.

The upper set of deep cervical glands near the angle of the jaw drain the naso-pharynx, pharynx, and neighbouring parts; and as their area of distribution includes a very large amount of adenoid tissue, they are more frequently affected than any others. Their rapid enlargement on one or both

sides generally signifies some acute infection in the area which they drain; and conversely, if they are normal it is in favour of there being no serious or acute throat affection. When they are chronically enlarged, the cause is generally tuberculosis.

In childhood the superficial lymphatic glands all over the body are relatively larger, in health, than in later life, and they are much more easily felt in various regions. Thus it is very rare indeed to meet with a child between twelve months and twelve years in whose groin and supraclavicular regions numerous palpable glands cannot be discovered. They are, of course, more readily felt in ill-nourished children, but with a little care they can be made out in almost all. This fact must be borne in mind when we examine the neck for enlarged glands, otherwise we may fall into the not uncommon error of regarding a normal characteristic of childhood as a sign of tuberculous infection. A careful investigation of this matter made by C. M'Neil,[1] shows conclusively that, when numerous supraclavicular glands are felt, this is not to be regarded as an indication of tuberculous infection of the lung. The fact that, when supraclavicular glands are rather larger than usual, those in the groin are *always* equally large, or more so, also points strongly in the same direction. It is comparatively rare to find demonstrably tuberculous glands in the supraclavicular region.

The Back.

In the healthy child the spine is characterised by great suppleness in all its varied movements. Even a small degree of *stiffness*, therefore, and the least *pain on normal movements* are to be regarded as important morbid signs; they generally indicate commencing spinal caries. Also, whenever a persistent or recurrent pain in the abdomen or lower limbs is complained of, it should always direct attention to the spine.

Rickety curvature of the spine is a very common condition (Fig. 42). In most cases it takes the form of kyphosis, but the curvature differs from that of Pott's disease (Fig. 43): *first*, in forming a wide curve and not an acute angle; *secondly*,

[1] Tuberculous Infection in Infancy and Childhood as revealed by the Cutaneous Tuberculin Test, *Edin. Med. Journ.*, April 1912, 336.

in disappearing when traction is made on the legs, except in severe and long-standing cases; and *thirdly*, in being unaccompanied by pain on passive movement, or by distinct stiffness.

Paralysis of the muscles of the back is sometimes diagnosed as spine disease. I have known this mistake made in cases of diphtheritic paralysis, in paralysis due to tumour of the cord, and in polio-myelitis.

Lordosis, resulting from congenital dislocation of both hips, is sometimes mistaken for spinal disease. The parents of mentally defective children also are very apt to attribute the inability of the children to sit up to disease of the spine.

FIG. 42. — Rickety Curvature of Spine in boy of 20 months.

FIG. 43.—Spinal Caries, showing acute curvature and characteristic attitude.

Compensatory twisting of the spinal column such as is caused by a short leg, by wryneck, or by paralysis of the spinal accessory nerve is apt to be mistaken for ordinary lateral curvature.

The Limbs.

In examining the limbs, the colour and temperature of the skin are to be noted. The size and consistence of the muscles, the outline of the bones, and the presence of any tenderness or pain in these structures are also to be observed. The joints and the hands and feet call for special attention.

The Joints.

In the examination of diseased joints the following points are of importance:—

1. The *child's age.*—Some diseases only occur in infants; others only in older children.

2. The *nature of the onset* of the disease.—Whether it began insidiously or suddenly, whether it followed an illness or injury, and whether it was accompanied by any constitutional symptoms such as fever, anæmia, or wasting.

3. The *distribution* of the lesion.—If one or several joints are affected, and whether the lesions are symmetrical. We have also to search for signs of disease elsewhere which may throw light on the joint condition—for example, any affections of the bones or of the tendon sheaths, abscesses anywhere, disease of the heart, lungs, abdomen, lymphatic glands, teeth, eyes, or other parts.

4. The *local conditions* to be investigated by inspection; palpation and questioning include—

(*a*) The *posture* of the limb—if kept flexed or extended.

(*b*) The presence of *muscular wasting.*

(*c*) The *swelling* of the joint—its exact position and characters. This may throw light on the extent to which the bones, ligaments, and synovial membranes are severally implicated.

(*d*) *Redness* of the skin or *distension of its superficial veins.*

(*e*) *Local heat.*

(*f*) *Fluctuation;* or *thickening of the synovial membrane.*

(*g*) *Mobility*—if lessened or increased in freedom and extent.

(*h*) The presence of *crackling* sensations on moving the joint, or of any creaking of the tendons or bones.

(*i*) *Tenderness* on being touched or on passive or active movement.

(*j*) Any history of *spontaneous or other pain*, either constant or intermittent—as in the case of the "jerking pains" of tuberculous hip disease.

5. An *X-ray examination* of the affected joint should, if possible, be made in *all* doubtful cases, as it often throws valuable light on the diagnosis.

The following are the most important joint diseases met with in children :—

Traumatic Synovitis.—Joint affections due to injury are, of course, far less common in little children than in schoolboys or young men. It should be remembered that a history of an injury is often given in cases which turn out to be tuberculous, syphilitic, or rheumatic. The onset in a case of traumatic synovitis is usually sudden, and there is an absence of disease elsewhere. Should the joint have been severely injured, there will generally be evidence of bruising visible under the skin within a day or two. The pain will usually be severe and the tenderness great.

I have several times seen a mild form of traumatic synovitis of the hip joint in young children (three to six) due to sudden forcible abduction of the limb. In one case it was caused by the child slipping on a polished floor with his legs widely separated. In two others it followed a too vigorous attempt to rival the gymnastic feats of a much bigger boy. Rapid recovery followed rest in bed.

While speaking of injuries, it may be mentioned that in children the *elbow joint* is much more frequently hurt than any of the other articulations. Both dislocations and fractures are common in this region, as well as bruising and separation of the epiphyses.

An interesting injury to the arm, which is not uncommon in young children, is what is called *Pulled Elbow*. This condition is apt to be mistaken for traumatic synovitis. It consists in a subluxation of the head of the radius out of the orbicular ligament. The usual cause of the injury is a sudden jerk given to the arm when in the position of extension. It is apt to occur when a nurse tries quickly to stop a young child, who has tripped, from falling. Immediately after the injury the arm hangs down, as if paralysed, and is pronated and slightly flexed. Pressure over the head of the radius and all movements of the elbow cause sharp pain.

Voluntary supination is impossible. The prognosis as to complete recovery of movement is very good, but the accident is apt to recur. The treatment consists in forcibly extending and supinating the forearm, while at the same time pressing the head of the radius back into its place. The arm is then fully flexed, and put up for two or three days in a sling.

Tuberculous Joint Disease.—Tuberculosis is the commonest cause of disease of the joints in children, and it may affect them at any age (Chapter XXXVII.). Its onset is often insidious, but sudden exacerbations from rupture of a focus in the bone into the joint are not uncommon. A distinct history of recent injury is frequently given; and there has often been fever, anæmia, and wasting before the joint affection was noticed. The joint disease is sometimes single, sometimes multiple, but usually not symmetrical. Other tuberculous lesions may be present in the bones, glands, lungs, abdomen, or elsewhere.

The affected limb is kept flexed, and there is generally well-marked muscular wasting. There may be little or no redness, but the local temperature is usually slightly raised. The amount and character of the swelling vary, but whenever the affected joint is at all superficial in its position, the synovial membrane will be found to be thickened. Slight rigidity, with limitation of movement, is an early and characteristic sign. If the affected joint is in the lower limb, lameness is generally the first symptom noticed. The amount and character of the pain vary greatly in different cases. Sometimes it is severe. This is often so in hip-joint disease, in which it is felt in the neighbourhood of the knee. "Jerking pains" at night are very characteristic of hip-joint disease. In many of the other joints, however, pain is often almost entirely absent in early tuberculous disease.

Arthritis from Congenital Syphilis.—This condition is very rare in babies. It is generally met with about the time of the second dentition (five to fifteen). The onset is insidious, and there is little or no constitutional disturbance, the child seeming merely a little out of sorts. The joint affection is often multiple, and the knees are the parts affected in the great majority of cases. What is particularly characteristic is the affection of both knees at once (Fig. 44), or one after the other, at an interval of a few weeks. When a child is found to have both knees swollen and to have little pain in them, this should

always suggest the probability of the case being of syphilitic origin. Generally, although not always, there is other evidence of specific disease to be found on examination of the teeth, bones, eyes, or other parts. The arthritis is frequently succeeded by interstitial keratitis.

The mobility of the joint is usually little affected, and it can be freely flexed and extended. The swelling is considerable, and there may be much fluid in the joint. There is however, little or no redness or heat to be made out, although the superficial veins are often distended. Sometimes the bones are also involved. There is little or no pain in

FIG. 44.—Arthritis from Congenital Syphilis.

most cases—merely uneasiness and tiredness after walking. Occasionally, however, the pain may be severe.[1] There is no starting at night. Suppuration never occurs. Generally the reaction to anti-syphilitic treatment (mercury and iodide of potash internally and mercurial ointment locally, or salvarsan) is rapid and satisfactory.

Acute Rheumatic Arthritis.—The age is an important element in the diagnosis of acute rheumatism. The disease never occurs before two, and very seldom before three, years old. Its onset may sometimes be sudden, but generally it is gradual. Occasionally only one joint is affected, and it is well to remember that this is, not very rarely, the hip joint.

[1] G. H. M. Dunlop, *Edin. Med. Journ.*, Dec. 1904, xvi., 516.

Other indications of rheumatism are always to be looked for and asked about—especially heart affections, rheumatic nodules, erythema circinatum, chorea, and sore throat (see Chapter XXXV.).

In the early stage of slight cases there may be comparatively little limitation of movement. The child limps, however, when walking, and at rest keeps the joint flexed and still. There is much less redness, heat, and swelling than is usual in adult patients; if in any joint case in a young child these are marked features, it is probable that the disease is not real rheumatism. The tenderness on handling may be considerable, although not nearly so bad as it usually is in adults. In true rheumatism pains in the fingers are common, but visible swelling of their joints is very rare indeed. Often, according to the history given, the previous pains have been of a trivial nature, and have been regarded as merely "growing pains," or as the result of a sprain.

The pain is always rapidly relieved by the administration of salicylates.

Among the morbid conditions which I have seen mistaken for rheumatism the following may be mentioned: Still's disease, gonorrhœal arthritis, septic arthritis, acute infective epiphysitis, syphilitic epiphysitis, infantile scurvy, infantile spinal paralysis, tetany, flat-foot, and "pulled elbow."

Chronic Rheumatic Arthritis rarely occurs in children. It causes great stiffness from fibrous thickening of the joints, and there are always indications of rheumatic disease, past or present.

Rheumatoid Arthritis or Osteo-Arthritis.—This is rare in childhood, but it does sometimes occur—mainly in older children and adolescents. It resembles the adult disease in its clinical features, and, like it, is gradual in its onset and very chronic in its course. Several joints are affected and the distribution of the lesions is symmetrical. Bony changes occur in the later stages. The spleen and lymphatic glands are not enlarged; and there is no evidence of rheumatism or tuberculosis.

Still's Disease of the Joints (Chronic Arthritis with Enlargement of the Lymphatic Glands and Spleen).—This is a form of progressive polyarthritis which is much commoner in early childhood than ordinary rheumatoid arthritis. It used to be regarded merely as an infantile variety of that disease

and it is still an open question whether this is so or not. Dr Still,[1] however, has given reasons for believing it to be a separate malady.

Its onset is often early—before three years old. I have seen more than one case which began at fifteen months. Generally the local symptoms are slight at first, though accompanied by debility and pallor. Sometimes, however, the onset is acute and febrile, and there may even be rigors. The joint affection consists in a fusiform enlargement of many of the articulations, and it is symmetrical in distribution (Fig. 45). The knees, ankles, and wrists are often involved,

FIG. 45.—Still's Disease of the Joints in a girl of 5 years.
(Dr John Playfair's case.)

and affections of the cervical spine and of the sterno-clavicular and interphalangeal joints are especially characteristic. The capsule of the joint is thickened and feels pulpy, but there is little fluid effusion and no change in the bones. Suppuration never occurs. As the joints become swollen, the lymphatic glands of the affected limb usually enlarge considerably; and the spleen is also increased in size. The younger the patient, the more marked is the enlargement of the glands and spleen. The movements of the affected joints are sometimes little, if at all, limited in the early stages of the disease. Later, however, the limbs become drawn up and the joints stiffen. The muscular wasting is very great. When the hand is placed on the joint during movement, slight crackling, connected

[1] *Trans. Med. Chir. Soc. Lond.*, 1897, lxxx., 47.

with the tendons, is occasionally felt; but there is generally little or no pain or tenderness. There is no tendency for this disease to be accompanied by endocarditis; but in a large number of the cases which have been examined post-mortem, general pericardial adhesion has been found. The prognosis is bad, owing to the great debility which is present and the consequent risk of intercurrent disease.

The treatment consists in life in a dry, warm climate, careful feeding, continued gentle passive and active movements of the joints. Hot salt water baths and hot air baths are sometimes also useful, and, internally, cod liver oil, iodides, and arsenic.

The result of treatment, especially among the poorer classes, is often disappointing. The children are apt to become chronic invalids and to be carried off by intercurrent disease. Sometimes, however, care and good nursing result in more or less complete recovery. For example, a well-marked case, in a girl of four and a half, recovered completely after two years of treatment, partly at home and partly in Bath. Eleven years afterwards she was still quite well. A boy who had a very severe attack, beginning when he was six and lasting for many years, made, at last, a partial recovery. Now, twenty-two years after his first illness, he is able to do regular work in a shop, although one hip joint is quite ankylosed and his neck twisted and immovable.

Gonococcal Arthritis. — This condition, although not common, is occasionally met with in childhood. It may, though rarely, occur in young babies with gonorrhœal conjunctivitis or vulvitis, as well as in older children. It sets in at any stage of the disease, but usually between the third and sixth week.

Generally only one joint is affected, and it is a knee in the majority of cases. The sheaths of some of the tendons are also frequently inflamed. The affected limb is kept flexed. The amount of swelling varies greatly in different cases; suppuration is rare. In older children the local condition may be very like that met with in acute rheumatism. The pain, however, is often strikingly severe, even apart from movement, and the way in which salicylates fail altogether to relieve it is an important point in the diagnosis.

Septic Arthritis.—Other forms of septic arthritis are met

with in connection with many of the infectious diseases, such as scarlet fever, diphtheria, measles, enteric, influenza, erysipelas, and mumps. They also occur in connection with various general infections and local inflammations such as pneumonia, empyema, posterior basic and cerebro-spinal meningitis, otitis, and sore throat.

There is usually a sudden onset during the course of the primary disease. Often more than one joint is affected, and abscesses elsewhere (for example, in the cellular tissue or parotid) are not uncommon. The temperature is usually high and remittent in type. The joint affection is not always acutely painful, and its course is sometimes subacute.

Spontaneous dislocation of the hip joint, which occasionally occurs in cases of infectious disease, is to be accounted for by softening of the capsule of the joint from latent septic arthritis.

Joint Affections in Acute Poliomyelitis. — Occasionally acute joint swelling—especially of the ankle—is observed in cases of infantile spinal paralysis. This occurs usually at the onset of the disease and always recovers more or less rapidly. It is to be remembered because it may otherwise give rise to an error in diagnosis.

Hysterical Joint Affections.—When hysterical affections of the joints occur in childhood, they are generally found in older girls or boys; rarely, however, they are seen in quite young children. The onset is often sudden, and usually one joint only is complained of. The patient is often, though not always, a noticeably nervous and precocious child.

The limb is held rigid by the spastic contraction of the muscles. Under chloroform, however, this disappears entirely —except in a few cases of very long duration. There is often distinct wasting of the muscles from disuse, even in not very long-standing cases. The affected joint is not swollen and looks altogether normal—the pain present being out of all proportion to the objective symptoms. There is frequently some hyperæsthesia of the skin and other superficial parts. The pain is not increased by jarring movements of the joint. When the hip joint is the part affected, the gait differs from that of ordinary hip-joint disease, and it is apt to vary in character from time to time. The lameness usually increases under observation.

It is advisable to be very slow in committing oneself to a diagnosis of hysterical joint affection, and only to give a positive

opinion to that effect after prolonged study of the case. It may not, at first, be possible to distinguish between hysteria of a joint and early tuberculosis in a neurotic child. Amongst other things, a careful observation of the temperature and a tuberculin test may afford help in the diagnosis; and an X-ray plate should always be taken, if possible.

Painless Effusion into the Knee-Joints. — Sir William Bennett has drawn attention[1] to a form of painless swelling of the knee-joints which is sometimes met with in young girls of twelve or thirteen or older, and less commonly in boys. It is in itself a trivial affection, but has some importance because it is apt to be mistaken for tuberculosis of the joint. In girls it seems to have some connection with the onset of menstruation, and sometimes the symptoms are so trivial that it escapes the notice of the patient herself as well as that of her mother, until some injury causes the joint to be specially examined. Both joints are usually affected, the right being often the larger of the two. In slight cases the effusion is only discovered when the lower part of the synovial membrane is made to bulge by the child's standing up. In others, a considerable amount of fluid is present; but the joint is never tense unless there has been a superadded injury. The patients are generally pale, nervous children with various other complaints. When menstruation becomes established, the condition usually disappears. The treatment consists in careful attention to the general health, and an outdoor life with moderate exercise and gentle massage. The child must not be laid up, nor the limbs put in splints.

The Joint Affection of Hæmophilia consists in sudden effusion of blood into a synovial cavity—usually that of the ankle or knee-joint—along with stiffness, sometimes considerable pain, and a slight rise of temperature. When the joint affection is the first manifestation of the disease, as sometimes happens, its real nature is very apt not to be recognised. The affected joint generally shows no discoloration on the outside, and its appearance is very like that of a tuberculous arthritis. It occurs, of course, only, or almost only, in boys. The treatment consists in rest and fixation of the affected joint by means of a splint. Should the hæmorrhages recur, the joint is likely to be permanently damaged.

[1] *Injuries and Diseases of the Knee-Joint*, London, 1909, 34.

Articular hæmorrhages are sometimes also met with in cases of **Purpura**; and in **Erythema Nodosum** slight arthritis is occasionally found.

Occasionally arthritis of moderate severity occurs in young infants, which does not conform to any of the above-mentioned types. The cases of the kind which I have seen have all recovered, and in none has there been any relapse or any permanent injury.

FIG. 46.—Skiagram of Schlatter's Disease in boy of 14 years.

Schlatter's Disease (*Rugby Knee, Enlargement of the Tubercle of the Tibia*).—When asked to see a school-boy with "a sore knee," it is well to remember that the case may not be one of joint-lesion at all, but an instance of "Schlatter's Disease."

This small ailment consists in a swollen and tender condition of the tubercle of the tibia, with pain on movement, especially when the knee is extended as in going down stairs: there is no abnormality of the joint or of the bursæ in its neighbourhood. There may, or may not, be a history of a

blow on the knee, or of a special muscular strain having recently occurred. The condition is not a very uncommon one and may cause inconvenience and some anxiety; for, though the pain is not severe, it interferes greatly with active exercise and may be mistaken for rheumatism or for early tuberculosis.

An X-ray examination confirms the diagnosis and throws light on the pathology of the lesion. It shows that the downward prolongation of the upper epiphysis of the tibia, into which the ligamentum patellæ is inserted, has been separated somewhat from the diaphysis behind it (Fig. 46). This dragging forward of the prolongation of the epiphysis may be present not only on the painful knee but also on the other side. It is evidently the result of muscular overstrain, and it constitutes the predisposing cause of Schlatter's disease. The exciting cause of the pain and tenderness may be a fracture, or other acute injury due to a blow or sudden pressure on the unduly projecting tongue of bone.

The treatment consists in rest in bed with a posterior splint, followed by a prolonged period of abstention from violent exercise. The pain often persists for many months in spite of treatment.

The Hands and Feet.

Examination of the hands and feet—especially of the former—should never be neglected. We may often gather useful information from them regarding the patient's general condition, besides noting any merely local abnormalities.

They may, for example, throw light on the state of the nervous system. In chorea, the characteristic movements are seen in them as soon as anywhere. In tetany the attitude they assume is the most noticeable feature of the disease. In young infants, constantly clenched fists are often a sign of great nervous tension, and may indicate that a convulsive attack is impending. The way in which the hand is held in certain attitudes of the arm varies in different states of the nervous system. A knowledge of these variations may be found of considerable use in the examination of school children as to their fitness for mental work. This has been worked out

in an interesting and original way by Dr Francis Warner in his various writings.[1]

Inspection of the hands may reveal that the child habitually bites his nails (Fig. 47) or sucks his thumb. The recognition of such apparently trivial facts may not be altogether valueless in certain cases.

The state of the circulation is also seen in the hands and feet, as cyanosis and œdema show early in them.

Chilliness of the Extremities is a common complaint in delicate and nervous children, especially in babies with rickets, and in older children who suffer from some degree of chronic intestinal dyspepsia. The symptom causes considerable dis-

FIG. 47.—Bitten Finger Nails.

comfort and may give rise to griping pains in the abdomen. It is probably a cause as well as a result of dyspepsia.

The treatment of cold feet and hands consists in regulation of the diet to suit the digestion, in seeing to the child's being sensibly clothed and having plenty of fresh air and exercise, and especially in the regular use of the cold douche with reasonable precautions (Chapter XXXIX.). Occasionally small doses of thyroid may be useful.

Clubbing of the Fingers (Fig. 48).—The causation of this condition is still decidedly obscure. When it occurs, however, there is usually—probably always—some impediment to the circulation which is giving rise to engorgement of the sys-

[1] *Physical Expression*, London, 1885 ; *The Study of Children*, London, 1898 ; and others.

temic veins. The toes are usually affected as well as the fingers, and sometimes the nose and ears also. The presence of clubbed fingers is always important, and may sometimes help very much in the diagnosis of a lesion of the lungs or heart.

The *respiratory diseases* in which clubbing is oftenest found are phthisis, bronchiectasis, empyema, and chronic pneumonia. In young children it may be distinct within four weeks of the onset of the symptoms of the chest disease. If the latter

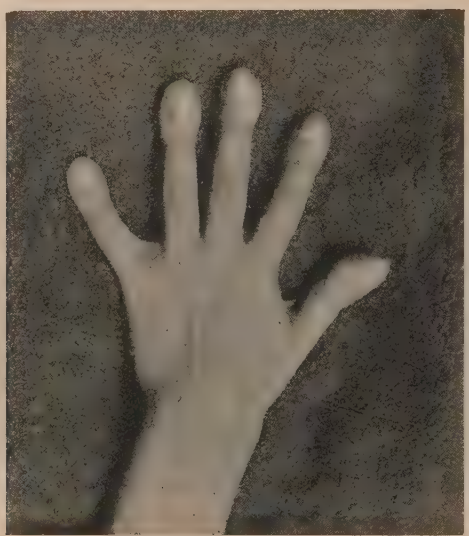


FIG. 48.—Clubbing of Finger Ends, from a case of Congenital Heart Disease.

recovers completely, the fingers will also soon become normal. The presence of clubbing may be useful in calling our attention to a latent phthisis or bronchiectasis which might otherwise have escaped detection.

In *congenital heart disease* severe clubbing is frequently present. Generally it accompanies cyanosis, but not always. It may not come on until the cyanosis has lasted for years, or it may never appear. Occasionally it is present when there is no cyanosis at all. When severe in degree, it forms a bad element in the prognosis. Dr Lees has pointed out[1] that clubbing is more likely to accompany a congenital heart

[1] *Trans. Path. Soc. Lond.*, 1880, xxxi., 58.

lesion when the foramen ovale does not remain patent, because under these circumstances there is more tendency to congestion of the systemic venous system. Older children who have severe and long-standing *valvular heart lesions* from endocarditis only show slight clubbing of the fingers. When the clubbing is severe, therefore, in young children with heart disease, it proves that the lesion is congenital in origin.

Clubbed fingers have been described as occurring in *hepatic cirrhosis* (F. Taylor, P. Lereboullet) and in *amyloid disease of the liver* (Eustace Smith). They also sometimes occur in *congenital hypertrophy of the colon.* A slight but distinct

FIG. 49.—Beaded Fingers, from a case of Rickets.

degree of clubbing is occasionally seen in delicate young children whose circulation is obviously defective but in whom no indication of any of the above-mentioned conditions is discoverable.

The Conformation of the Hands, and to a less degree of the feet, may greatly help in the diagnosis of several diseases. As examples of this may be mentioned the characteristic hands of achondroplasia, which distinguish cases of that disease from those of dwarfing due to rickets and other causes (p. 713). The shape of the hands in mongolism, cretinism, and hypopituitarism is also an important diagnostic feature in these diseases.

The extent to which the finger joints suffer in rheumatoid arthritis and in Still's disease of the joints helps to distinguish them from rheumatism (p. 75).

The Rickety Hand.[1]—In many cases of rickets the hands are characteristically altered in outline (Fig. 49). The rickety hand is usually long and slender. The fingers shows a tendency to spontaneous hyperextension and have a peculiar "beaded" appearance, the circumference of the joints being

FIG. 50.—Tuberculous Dactylitis.

FIG. 51.—Congenital Syphilitic Dactylitis.

less than that of the middle of the phalanges. This beading, as the X-rays show, is due to elongation with narrowing of the joints and the parts adjacent, and not to any actual thickening of the intervening diaphyses (Siegert).

The presence of **tuberculous** or **syphilitic dactylitis** (Figs. 50 and 51) sometimes throws an important light on the

[1] Siegert, *Verhandl. d. Gesellschaft f. Kinderheilk.* (Cassel), 1903, xx., 240; Koplik, *Arch. of Pediatr.*, 1904, xxi., 771.

causation of an obscure cerebral or abdominal case. These two conditions may be very like one another. The swellings of the fingers have a similar outline in both cases, and in both they are usually multiple. In syphilitic cases, however, the metacarpal bones are less frequently affected and there is much less tendency to suppuration. The diagnosis can generally be made from a skiagram, which shows the extent to which the interior and the surface of the bones are affected. In syphilitic cases, the condition is one of gummatous periostitis, the interior of the bone being either unaffected or sclerosed; while in tuberculous dactylitis any periostitis present is likely to be secondary to a caseous focus in the interior of the bone.

Deformities of the Thumbs and Great Toes in Myositis Ossificans.—These are described elsewhere (p. 696 and Fig. 194). They are of special interest because their recognition may lead to an early diagnosis of the commencing muscle change.

CHAPTER V

ON THE NOSE, THROAT, AND MOUTH

The Nose.

A CHANGE in the *shape* of the nose is occasionally significant in diagnosis, especially the broadening and depression of the bridge which are found in many cases of congenital syphilis. Poorly developed and thickened alæ often accompany chronic nasal obstruction, and an exaggeration of the hollows above the alæ—"nasal dimples"—are usually, if well marked, an indication of the presence of adenoids, and are sometimes noticeable before the habit of mouth-breathing has been acquired.

Nasal Obstruction, due to thickening of the mucous membrane by catarrh or other disease, is always suggestive of congenital syphilis when it occurs in a young infant, and of adenoids in older children; but acute nasal catarrh may be caused by streptococci, pneumococci, diphtheria bacilli, or other organisms. *A subacute or chronic nasal discharge should always arouse a suspicion of diphtheritic infection.* A unilateral nasal discharge generally indicates the presence of a foreign body, such as a boot-button, a pea, or a bead in the nose. Polypi are rare and are only met with in older children.

When nasal obstruction sets in acutely, great distress may result, especially in young infants, because it prevents the child breathing comfortably through the nose. Besides causing local discomfort and headache, it leads to serious interference with the free entrance of air into the chest, so that it may constitute a dangerous complication in such conditions as pneumonia and acute bronchitis. In these, attention to the nasal obstruction is always an important part of the treatment.

Catarrhal obstruction of the nasal passages may generally

be greatly relieved by the frequent use of a simple alkaline cleansing lotion (sod. bicarb. 10 grs., ac. boric. 10 grs., sod. chlorid. 3 grs., and water 1 oz.). This should be warmed to the temperature of the body and may be sniffed into the nostrils from a teaspoon, or gently injected by a medicine dropper.

Rubbing the Nose.—One of the early symptoms in guinea-pigs and other animals that are suffering from anaphylaxis is a violent rubbing of the nose with sneezing and sniftering. The same symptoms are often seen in little children with asthma, and also in those who have an idiosyncrasy for eggs or other kinds of food (see Appendix C).

Epistaxis.—Nose-bleeding is a common symptom in childhood. It may be due to a passing cerebral congestion, to acute nasal catarrh, to the child having picked off a small scab near the front of the septum, to a foreign body, or to a blow on the nose. The presence of adenoids predisposes to epistaxis. In the majority of cases, bleeding from the nose is a matter of no importance. Sometimes, however, it occurs as a symptom of some form of serious disease. It is not uncommon, for example, in congenital heart-disease, at the beginning of acute rheumatism, in enteric, in some epidemics of influenza, in chronic nephritis, and in such blood diseases as leukæmia, purpura, and hæmophilia. It may, in rare cases, be a precursor of hay fever. When epistaxis occurs in a child who is lying down, the first sign is usually the vomiting of the blood which has been swallowed, and this may cause a mistaken diagnosis of gastric hæmorrhage.

To stop the bleeding, the child should be made to stand up with the arms raised and the chest expanded, while the feet are kept warm and cold cloths applied to the nose. In obstinate cases, a small plug of cotton wool soaked in peroxide of hydrogen should be placed inside the nostril and pressed inwards. The bleeding point is almost always situated near the front of the septum. Plugging of the nares is very rarely advisable.

The Mouth and Throat.

The examination of the mouth and throat includes the inspection—and sometimes the palpation—of the lips, tongue, teeth, gums, cheeks, palate, tonsils and fauces, pharynx, naso-pharynx and larynx.

It is extremely important that the mouth and throat should always be thoroughly examined in all cases of feverish illness in childhood, even if no local symptoms are complained of. Many cases of obscure pyrexia are cleared up at once by such an examination.

Methods of Examination.

Inspection.—It is generally easy to induce a baby who is not frightened, and is not teething, to open his mouth if you gently touch his lips with the finger; and, once the mouth is open, the finger can readily be passed along the gums till it touches the pharynx, thus compelling the child to give a good view of the fauces.

The main points to be attended to in examining the throat are, first, to have the child facing a good light in such a way that, when the mouth is opened, the fauces will be illuminated at once without any change of position; and secondly, to have his arms held, or secured to his side by a towel pinned round him, so that he may not be able suddenly to seize the tongue-depressor or the hand that holds it. If the examination of the throat is carried out rapidly and gently the first time, and no struggling allowed, it will be much easier on the next occasion; while, if the child is allowed to struggle, it will be more difficult each time. A small electric torch is a very useful aid in the examination of the mouth and throat.

Digital palpation of the fauces, pharynx, and naso-pharynx is especially important in young children, because it is often so difficult in them to get a good view of these parts and, with practice, much information can be got from it. Without palpation, it may be impossible to make sure of the presence or absence of a retro-pharyngeal abscess or of adenoids.

When the throat is examined with the right forefinger in older children, the cheek should be pressed between the side teeth by the fingers of the left hand, so as to prevent the examining finger being bitten; or a gag may be used.

The Breath.

A healthy child's breath is, of course, free from odour of any kind, but this is often changed in illness. Occasionally, for example, the breath has a distinct smell of acetone, the

significance of which is considered elsewhere (p. 453); and, often, for one reason or another, it is decidedly offensive.

Foul Breath.

In the course of severe lung diseases, such as pneumonia or pulmonary tuberculosis in delicate children, a putrid smell of the breath may suddenly appear. This is a grave symptom as it generally means the onset of gangrene of the lung. Under ordinary circumstances, an offensive breath has a much less serious significance; still, it may occasion so much distress and discomfort that the recognition and treatment of its cause are matters of considerable importance.

In children with carious teeth, or pyorrhœa, ulcerative stomatitis, unhealthy tonsils with decomposing matters in the crypts, or bronchiectasis with ill-smelling sputum, a foul breath is a common and easily explained symptom, and the indications for its treatment are more or less obvious. Sometimes, also, an offensive odour occurs in children with a coated tongue and other indications of digestive derangement.

The most perplexing cases, however, are those in which, although the breath is distressingly offensive to the patient and his friends, no apparent cause can be discovered. The children are often, in other respects, in good health. It has been suggested that in these cases some foul smelling organic matters derived from the food, which should have been dealt with by the liver and bowel, have escaped these purifiers of the system, and are being excreted by the glands of the upper digestive and respiratory mucous membranes instead. Some of the cases are very intractable, but many of them yield rapidly to the regular use of simple measures.

Treatment.—The following treatment may be tried:—

(1) The amount of food taken must be confined to normal proportions; these children are often very large eaters.

(2) The proportion of sapid substances in the food should be specially limited.

(3) Plenty of open-air exercise must be insisted on.

(4) The bowels should be kept freely open by a daily morning dose of Carlsbad salts or of mineral water.

(5) Rhubarb and soda may be given twice daily, and a dose of calomel once every week or ten days.

(6) Charcoal lozenges or biscuits and a weak permanganate of potash mouth-wash are also sometimes useful.

The Lips.

Pallor of the lips forms, in children as in adults, a fairly trustworthy sign of anæmia; and a slight purplish tinge is often of importance in heart and lung cases as an indication of commencing cardiac failure.

Eczema and catarrhal herpes of the lips are not uncommon in young children, and several forms of stomatitis, such as the aphthous, syphilitic, and diphtheritic varieties often affect them severely. During the onset of measles the inside of the lips may show Koplik's spots, though their commonest site is the inside of the cheeks near the first molar tooth.

Cicatricial fissuring of the lips, as has been elsewhere noted, is an important sign of congenital syphilis, and a slighter degree of fissuring, confined to the mucous membrane, is seen in many cases of mongolism.

Dribbling of Saliva from the mouth is met with under various conditions. It is normally present in most babies during teething, especially when there is any irritation of the gums from stomatitis. Sometimes it sets in during acutely painful conditions of the throat which make the child unwilling to swallow his saliva; and it is a characteristic symptom in spasmodic stricture of the œsophagus in which the saliva is greatly increased in amount. It is also a very common and significant symptom of mental defect (p. 661).

The Tongue.

In new-born children the mucous membrane of the mouth is of a dark red colour, and for the first few months it is noticeably dry owing to scantiness of the saliva. For the same reason the tongue is apt to be more or less coated in young infants.

It is not uncommon in children to find red areas on the dorsum covered with thinned epithelium and bounded by white or greyish elevated margins which have an irregularly

rounded contour. When this condition is extensive its irregular outlines resemble those of a map, and hence it is spoken of as the "mapped" or "geographical tongue" (Fig. 52). Usually there is no local pain or discomfort in these cases, and no apparent digestive disturbance. The condition has also no connection whatever with congenital syphilis, and it is certainly not a tuberculous lesion. In

FIG. 52.—Geographical Tongue.

the rare cases in which there is pain, it is best treated with krameria lozenges.

Tongue-tie is often complained of by mothers, but is seldom found to such an extent as to warrant operative interference. When, however, the frænum is so short that the tip of the tongue is turned downwards when an attempt is made to protrude it, it should be divided, as it may possibly interfere with sucking in infancy and in after life with articulation.

A small erosion or *ulcer* is occasionally found *below the tip of the tongue* (Fig. 53) and often on the margin of the frænum. This almost always indicates the presence of whooping-cough, during the spasms of which the tongue is frequently shot out over the sharp lower incisors. It may, however, occur in any form of violent cough if the teeth are sharp; and even, rarely, without cough, in cases where the movements of the tongue in sucking are very energetic.

The *strawberry tongue*, which is characteristic of scarlet fever on the third day and onwards, is sometimes a great help in the diagnosis of that disease. It is well, however, to remember, not only that this symptom is often absent in scarlet fever, but also that a typical strawberry tongue is sometimes seen in other conditions.

FIG. 53.—Infant with Whooping-cough and Congenital Syphilis. Ulcer under tongue, œdema of eyelids, depressed bridge of nose, and nasal discharge.

Fissuring of the Tongue, as mentioned elsewhere (p. 677), is a very common and characteristic symptom in mongolism. It is mainly due to the vigorous and persistent sucking of the tongue which these children practise. It is also met with not very rarely in cretins and in other children, whether mentally defective or not, if they are addicted to sufficiently continuous sucking of the tongue.

Tongue-swallowing (*Aspiration of the Tongue*).—In some delicate babies there is a tendency to choke from the tongue falling right back into the pharynx and so obstructing the opening of the glottis. For this to occur there must be a flabby tongue with a long frænum and generally loose attachments. There seems, however, to be no truth in the old idea that tongue-swallowing is due to too free division of a tight frænum.

I have seen aspiration of the tongue occur in the paroxysm of whooping-cough, and it also occurs in laryngismus. It is favoured by the presence of nasal obstruction from catarrh. The worst and most persistent case of the kind which I have seen occurred in a wasted baby with subacute posterior basic

meningitis. In it the parts were so relaxed as to appear paralysed. Aspiration of the tongue is an occasional cause of sudden death in young infants.

The Teeth and Gums.

The examination of the teeth has been already discussed (Chapter III.), and stomatitis, as it affects the gums, will be considered later.

The Cheeks.

Sucking-pads.—An interesting peculiarity in young children is the prominence of the cheeks caused by the sucking-pads.[1]

FIG. 54.—Sucking-pads in a child of 7 months.

These are little separate encapsulated masses of fat which lie outside the buccinator and masseter muscles and prevent the falling in of the cheeks during the normal process of sucking. As emaciation proceeds, these pads waste much more slowly than the surrounding adipose tissue. This results in the appearance on each cheek of a rounded projection, like half a small marble, which gives a peculiar look to the child's face, especially when he cries (Fig. 54). These projections

[1] Ranke, *Virchow's Archiv.*, 1884, xcvii., 527; Lehndorff, *Jahrb. f. Kinderheilk.*, 1907, lxvi., 286.

are seen in children under a year old who are wasting rapidly from any cause, such as diarrhœa. Rarely they are found also in older children. I have seen them very well marked in a boy of eleven years—a patient of the late Professor Wyllie's—who had diabetes.

The Palate.

Epithelial Pearls.—In many infants during the first few weeks little yellowish white rounded nodules may be seen about the mesial line of the hard palate. They vary in size from a pin's head to a millet-seed, and are slightly raised above the level of the surrounding mucous membrane. These nodules are sometimes called *epithelial pearls*, being composed of collections of epithelial cells, and they have usually no clinical significance. In unhealthy infants, however, they may occasionally ulcerate. When unusually large they may give rise to unnecessary anxiety, and have even been mistaken for manifestations of congenital syphilis.

Chronic *ulcers* are not uncommon towards the back of the hard palate in wasted babies of a few weeks. They are caused either by the nurse's finger, which has been too roughly used in cleansing the mouth, or by the continuous pressure of some hard body which the baby has been allowed to suck. They often recover in a week or two under weak boric applications, but sometimes they are very obstinate. These ulcers are often referred to as "*Bednar's aphthæ*."

Abnormal vaulting of the palate may often be found even in early infancy, but the deformity is rarely very great until after the second dentition. The significance of such peculiarities is alluded to elsewhere (p. 660).

Perforation and destruction of the soft palate and of the pillars of the fauces are due to congenital syphilis in most cases, but may sometimes be caused by lupus, or rarely, and to a much less extent, by Vincent's angina.

The palate should be carefully examined in cases of suspected measles as the rash may appear there from twenty-four to forty-eight hours before it is recognisable on the skin. The rashes of scarlet fever and chicken-pox are also often seen in this position.

Stomatitis.

Various forms of inflammation of the mucous membrane of the mouth are common in childhood, and they are of considerable importance for several reasons. They are apt to be overlooked, and often give rise to a surprising degree of fever and general disturbance. They may occasion great distress and interfere very much with chewing and swallowing, and consequently with the nutrition of the child. The main varieties of stomatitis are as follows:—

1. **Catarrhal Stomatitis.**—Catarrhal stomatitis may be local or general. When local, it is usually due to the irritation of decaying teeth. When general, it may be caused by a dirty teat or "comforter." It is commoner during teething than at any other time.

The symptoms consist in swelling, pain, heat, and redness of the mucous membrane of the mouth with a rise of temperature (sometimes even to 104°), and other signs of febrile disturbance. The tongue is covered with a thick yellowish white fur. There is generally also an increased secretion of saliva which runs out of the mouth, and there may be some enlargement and tenderness of the lymphatic glands below the jaw. The child often takes the breast or bottle eagerly at first, but stops very soon and cries with pain and annoyance.

The *treatment* consists in giving cold food from a spoon if sucking is painful, and in swabbing the mouth with peroxide of hydrogen or a saturated solution of boric acid after each feed. In obstinate cases the mucous membrane should be painted once daily with nitrate of silver solution ($\frac{1}{2}$ to 1 per cent.), and 2 or 3 grs. of chlorate of potash given internally every three or four hours. In older children, lozenges containing formaldehyde are also useful. Recovery usually takes place in about a week.

2 **Aphthous Stomatitis.** — The etiology of aphthous stomatitis is still unknown, although various organisms have been described as its cause. It is regarded by many authorities as not contagious, but we frequently see it in several members of the same family.

The aphthæ appear as small rounded ulcers, which begin as vesicles and usually have a little yellowish exudation about their edges. They vary greatly in number in different cases,

and the amount of general stomatitis which accompanies them also varies. If the general stomatitis is severe there is usually a considerable degree of fever (102° to 103°). In some cases the ulcers are accompanied by little redness of the intervening mucous membrane, and in these cases there may be no general disturbance. A good deal of local tenderness and consequent interference with the feeding are frequently present.

The local application of hydrogen peroxide, boroglyceride or permanganate of potash (1 to 1000), along with the internal administration, three or four times daily, of chlorate of potash (2 grs.) and tincture of the perchloride of iron (2 minims) is usually rapidly followed by recovery.

3. **Parasitic Stomatitis.**—Parasitic stomatitis or thrush is due to the growth, on the mucous membrane, of an organism related to the yeast fungus (*Saccharomyces albicans*). This organism occurs in the mouths of many healthy children, but stomatitis results from it only in those who have been weakened by disease. Its doing so in them seems to be due largely to diminution of the normal healthy movements of the mouth which are antagonistic to the growth of the fungus. Thrush in the mouth is often accompanied by diarrhœa.

At first, the disease causes small white raised spots on the tongue and on the inside of the cheeks. These look like fragments of milk curd, but can only be removed by using some force, and leave an abrasion behind. In severe cases the spots spread till they form a continuous false membrane which may extend to the throat, or even in rare cases down the œsophagus. When a portion of the white patch is treated with liquor potassæ and examined under the microscope, it is found to consist of the filaments and spores of the fungus along with epithelial cells, milk globules, and bacteria. There is usually catarrh of the mucous membrane between the patches.

The *treatment* consists in removing the spots gently by means of a soft rag moistened with bicarbonate of soda solution (1 drm. to 5 oz.), and applying permanganate of potash solution or glycerine of borax to the raw surface. Everything that comes near the child's mouth, or has to do with his milk, must be sterilised so as to avoid reinfection, and attention must be given to the causes of the general debility.

4. **Ulcerative Stomatitis.**—In mercurial, lead, and phosphorus poisoning, ulcerative stomatitis is apt to occur and it is also sometimes a symptom of scurvy. In the great majority of instances, however, we meet with it in ill-fed and badly-housed children with carious teeth, as a sequel to infectious complaints such as measles. It does not occur before the appearance of the teeth, and is commonest between five and ten years of age.

The ulceration begins at the alveolar margin and spreads thence to neighbouring parts. Sometimes the teeth are loosened and the jaw may even become necrosed. The lymphatic glands are enlarged, and there is a constant dribbling from the mouth of saliva, which is frequently blood-stained. The tongue presents a dirty brownish-yellow fur and the breath is fetid. The bacteriology of the condition is not thoroughly understood, but fusiform bacilli along with spirilla, like those found in Vincent's angina, have been frequently described and also an amœba (*Entamœba gingivalis*).

In cases due to scurvy or poisoning, the treatment of these conditions is, of course, the main thing. The special treatment consists in giving chlorate of potash (2 grs.) with tincture of perchloride of iron (2 minims) every two or three hours; and if the child is cachectic, opium is sometimes very useful. The mouth should be washed out frequently with weak permanganate solution, or a stronger solution (1 to 1000) may be painted on the gums. The patient's nutrition and his hygienic surroundings must be improved, if possible, and, if in hospital, precautions must be taken against his infecting other children. Carious teeth should be removed.

5. **Gangrenous Stomatitis.**—Cancrum oris or noma is fortunately not a very common disease. It only occurs in children whose vitality has been seriously lowered by profound malnutrition or by one of the infectious diseases, especially measles; and it is not infectious except to other debilitated individuals.

A variety of micro-organisms have been found in these cases, but their exact relationship to the causation of the disease has not yet been determined. Recently fusiform bacilli with spirilla have been described as characteristic.

The inflammation begins as a small red patch on the gum, or on the cheek near the angle of the mouth. This rapidly spreads and soon assumes the characteristics of moist gangrene,

destroying all the tissues affected (Fig. 55). In the majority of cases, the child dies in a state of collapse, or with symptoms of septicæmia or pneumonia. Occasionally recovery takes place with, or rarely without, active treatment, and great

FIG. 55.—Cancrum oris following measles. (Dr Harvey Littlejohn's case.)

deformity is always left. In girls, noma is sometimes met with on the vulva.

The treatment consists in a thorough application of Pacquelin's cautery, pure carbolic acid, or some other escharotic; and opium should be given in full doses.

6. and 7. **Diphtheritic and Syphilitic Stomatitis** need not be specially described here.

8. **Other Forms of Infective Stomatitis.**—One severe case of pseudo-membranous stomatitis in my ward, which was due to a streptococcus, after resisting all other treatment, recovered rapidly when treated by injections of anti-streptococcal serum.[1] Another similar case which looked very like diphtheria was found to contain a form of leptothrix; in it the application of peroxide of hydrogen was very efficacious.

Catarrhal Sore Throat.

Ordinary sore throat may be present at any age and is common in infants as well as in older children. In infancy its presence is sometimes shown only by pyrexia, but often the child also refuses his food and shows signs of pain on swallowing. In older children, slight degrees of catarrhal sore throat often give rise to a persistent cough as the most prominent symptom.

The recognition of acute sore throat is generally easy if the fauces are inspected; but, especially if fever is present, its presence may indicate the beginning of one of the infectious diseases, such as scarlet fever, diphtheria, enteric, rubella, measles, or influenza.

Acute tonsillitis is not uncommonly a rheumatic symptom, and the heart should always be watched during the attack for any cardiac dilatation or endocarditis. When several children in a household suffer from sore throat, the condition of the drains and the milk and water supply should be investigated.

The *treatment* of the condition in children does not differ from that in adults. In acute cases, it is generally well to begin with a mercurial purge, and this has often a decided effect in relieving the condition of the throat. Small doses of tincture of guaiacum or of chlorate of potash may be given, and in possibly rheumatic cases salicylate of soda. The frequent recurrence of sore throat generally indicates the necessity of an operation for enlarged tonsils or adenoids. Whether these conditions are present or not, the recurrence may sometimes be prevented by the administration of an autogenous vaccine.

[1] J. S. Fowler, *Arch. of Ped.*, 1901, xviii., 356.

Vincent's Angina.

Vincent's angina is a mildly infectious form of ulceration of the throat, mouth, and gums, which is characterised by the formation of a false membrane, and is apt to be mistaken for diphtheria. There may be deep ulceration of the tonsil, and the false membrane sometimes spreads on to the palate and uvula; perforation of the pillars of the fauces is much commoner than in diphtheria. The disease is often confined to one side. The fever and other constitutional symptoms only last for a few days and are not severe; the glandular enlargement does not tend to suppuration.

Scrapings from the surface of the lesions show a mixture of fusiform bacilli and large spirilla, similar to those found in ulcerative stomatitis and in noma. The diagnosis depends mainly on the presence of these organisms; but the depth of the tonsillar ulceration, the patches on the gums and cheeks, and the mildness of the symptoms are so far characteristic.

The prognosis is good, as extension to the larynx and trachea is very rare. The lesions, however, sometimes react slowly to treatment and may take several weeks to heal.

The treatment consists in the assiduous application of hydrogen peroxide or some other antiseptic, and in the repeated irrigation of the mouth and throat with sterile water or saline solution for ten minutes at a time.

Chronic Enlargement of the Tonsils.

Enlarged tonsils are usually, though not always, associated with adenoids. If they resist the use of astringent and antiseptic applications (Appendix I., Form. 3, 4, and 5) they should always be removed by operation, if they are giving rise to obstruction, and also in children who are subject to rheumatic affections or to recurrent catarrhs or bronchitis, as they form a focus from which septic infection is constantly apt to spread.

Adenoid Growths.

Even in infants of a few months adenoids may be present, and they are very common at all ages. The change which their presence produces in the face has been already referred to (p. 11), and their effect on the form of the chest is also described elsewhere (p. 490).

In *young infants* our attention is drawn to the condition chiefly by signs of local obstruction. There is usually mouth-breathing, often impairment of hearing, sometimes otorrhœa, obstructed respiration with snoring, or with a sort of croaking which may be mistaken for congenital laryngeal stridor (p. 531), and, occasionally, some interference with taking the breast. In very young babies there may be no recognisable adenoid facies at first, because it is some time before the child learns the relief of breathing through the mouth. There is often a history of recurrent bronchial catarrh.

In *older children* one of the most important symptoms is deafness which may, or may not, be accompanied by recurrent attacks of middle ear catarrh. Headache is common and the voice is noticeably nasal in tone. The child generally sleeps with his mouth open, and snores. In some cases there are frequent attacks of bronchitis which usually begin with a sore throat; in some there are asthmatic symptoms; in others a peculiar choking paroxysmal cough which is apt to be mistaken for whooping-cough. When there is much naso-pharyngeal obstruction, night terrors often occur, and enuresis is not uncommon. General debility and languor are present in many cases.

The term "*Aprosexia*" has been applied to a peculiar form of mental dullness which is common in children with much nasal obstruction from adenoids. The exact causation of the condition has not been determined, but it looks as if the blocking of the circulation through the nose and naso-pharynx interfered in some way with that of the frontal lobes. The children are usually quite bright and lively at times; but often, especially when the mucous membranes are swollen from catarrh, they become dreamy, absent-minded, and timid to such a degree that their teachers may suspect them of being mentally defective. The connection between these symptoms and the adenoids is proved by the immediate and striking improvement which follows the removal of the latter.

Treatment.—Adenoid growths may be treated by medical means only, or by surgical, followed by medical measures. The choice of treatment depends, to a large extent, on the severity of the symptoms and on the stage of the disease at which the patient is first seen.

If the condition is recognised early, at a time when the first

signs of the disease are beginning to appear, much improvement may be obtained in many instances by the persistent use of simple medical measures—and complete recovery in not a few. At present, however, most of the cases which are brought to the physician on account of adenoid symptoms already show the disease in such an advanced form that operation is certainly advisable.

Medical Treatment.—It has been the experience of most physicians that, occasionally, cases in which the operation has been postponed, and in which the health has in the meantime improved greatly under general treatment, have undergone a process of entire recovery. Much has also been written of late about the efficacy of certain simple breathing and other exercises (suggested by Mrs E. Handcock) in restoring the naso-pharynx to a healthy condition, or at least lessening, if not altogether removing, the obstruction.[1]

The treatment recommended consists in regular drill and breathing exercises in a well-aired room. The children are taught to make a series of forcible inspirations, alternating with vigorous blowing of the nose, carried out in such a way that the nostrils are not compressed during the act. After this has been repeated about ten times, sneezing is induced by the application of a mildly irritating powder to the anterior part of the septum just inside the nostril (iris root and soap). The sneezing is continued until the passages are clear and a "dry sneeze" results; and, thereafter, the inspirations and blowing of the nose are repeated, first with both nostrils and afterwards with one at a time. It is also good for the patient to further cleanse the passages by sniffing up an alkaline and antiseptic lotion (*e.g.*, ac. boric. and sod. bicarb. āā 10 grs., sod. chlorid. 3 grs., water 1 oz.); and the child should be encouraged to keep his mouth closed habitually and to breathe through his nose.

Several school medical officers, who have organised classes for the practice of methods such as those above-mentioned, have reported encouraging results, and it seems likely that more improvement in the local symptoms may be effected in this way than was formerly thought possible. The general health and digestion are said also to benefit remarkably.

[1] See J. Ormiston, *Lancet*, 1918, ii., 240; Gertrude H. Hickling, *Brit. Med. Journ.*, 1920, i., 147; and Alex. Fraser, *Brit. Med. Journ.*, 1920, i., 310.

It is probable, therefore, that medical treatment of this kind is well worth trying in early cases and in those where the general health is good, provided there are no serious facial or thoracic deformities, and no indications of chronic or recurrent affections of the ears or of the respiratory or digestive organs. They should also be made use of when the symptoms are moderate in degree and have only set in recently during an attack of infectious disease, or as the result of some general or local condition which is likely to yield to treatment.

Surgical Treatment.—There are several important indications for surgical treatment in cases of adenoids; and what there is to be said on the subject applies equally to the subject of removal of the tonsils. In the *first* place, an operation is necessary whenever the *local obstruction* due to the growths is preventing the entrance of air through the nasal passages to a serious extent, because we know that a continuance of this will certainly result, if it has not already done so, in deformity of the features, an unpleasant change in the voice, and an alteration in form of the thorax which will prevent its full and free expansion in respiration, and therefore be detrimental to the general health. If the respiratory obstruction develops in infancy, the early removal of its cause is even more urgently called for, because it may also interfere with the child's nutrition by preventing his taking the breast or bottle with comfort.

There are, *secondly*, in a few cases, reflex nervous symptoms which seem to be due to the presence of adenoids and which sometimes, though not always, cease on their removal. Among those described are laryngeal spasm, paroxysmal coughing, asthmatic attacks, and nocturnal enuresis.

The *third* indication for operation—and a very important one—is the recurrence of attacks of certain acute diseases of an infective nature. The naso-pharyngeal adenoid tissue is peculiarly liable to bacterial invasion of all sorts, and forms a ready nidus from which infection spreads to neighbouring parts. This may occur even when the adenoid hypertrophy is moderate in degree.

Examples of the common types of repeated infection starting from adenoids are found in such conditions as recurrent nasal catarrh, sore throats, middle ear inflammation, and catarrh of the trachea and bronchi. We often also

find indigestion, pallor, and general debility which owe their origin to the constant swallowing of septic naso-pharyngeal secretions. In rheumatic children the recurrence of such catarrhal affections is especially dangerous. When they have adenoids, therefore, an operation should always be done.

In some instances the parents are strongly opposed to any surgical procedure; but, if the child is otherwise healthy, there is little ground for this. The very large experience of such operations which has accumulated in the course of the last thirty years has shown conclusively that the results are entirely satisfactory in the great majority of cases, that the risk is very small, and that the serious consequences that have been predicted by some writers practically never occur. It has, for example, been suggested that the child's voice in singing may be permanently injured. When this occurs, however, it is probably always due to the operation having been done badly so that the pillars of the fauces or the soft palate have been torn.

It is important that, after the operation, attention should be given to the child's breathing, and that he should have regular exercises to favour the development of his chest as much as possible.

Retro-Pharyngeal Abscess.

In examining children with dyspnœic symptoms or sore throat — especially those under two — it is important to remember the possibility of retro-pharyngeal abscess. It is not a common condition, but its recognition and proper treatment are of great importance.

Chronic abscesses in this situation are often the result of *tuberculous disease* of the cervical vertebræ, and the pus is situated, at first, between the bone and the prevertebral fascia. In *acute* cases the abscess develops in front of the prevertebral fascia and pushes the posterior pharyngeal wall before it, so that it bulges into the back of the throat, interfering with deglutition and respiration. It is generally due to infection of the lymphatic glands by *pyogenic organisms* from the throat or elsewhere. It is the acute or subacute cases to which the following remarks apply.

The onset of the *symptoms* is usually insidious. The child is restless, and sometimes refuses his food, and seems pained when drinking. There may be some stiffness of the neck. The breathing early assumes a snoring character, especially when the child is asleep; but generally it is ten or fourteen days before the abscess is sufficiently large to cause interference with breathing. Gradually the respiration becomes more and more difficult, and stridor accompanies both inspiration and expiration; and the breathing is worse when the child is laid down. When the patient attempts to drink, he is apt to choke, and the fluid is coughed out of his mouth and nose. Generally neither hoarseness nor cough are present, but this is not always so, as the condition may be accompanied by laryngeal catarrh. Occasionally there is a definite external swelling in the neck. The only certain means of diagnosis, however, is digital exploration of the pharynx, which at once reveals the presence of the abscess, even when it cannot be recognised by inspection.

The *treatment* consists in immediate incision. In acute cases this is best done through the mouth by means of a tenotomy knife, the child being turned on his face immediately after the incision, so that he may cough out the pus. Large abscesses should usually be opened through the neck.

CHAPTER VI

ON THE CLINICAL PHYSIOLOGY OF THE INFANT'S ALIMENTARY TRACT, AND SOME DERANGEMENTS OF ITS FUNCTIONS

Development of the Digestive Organs.

Salivary Glands.—Even during the first week of life, a little saliva is secreted which has some action on starch; but, for the first six months, the amount is so small as to be of no practical importance in normal digestion. During the second six months, its quantity and its power of acting on starch steadily increase so that by the end of the first year they are considerable.

Pancreas.—Before the child is born, the pancreatic juice is found to act to some extent on proteins and neutral fats; and the secretion of the intestinal mucous membrane which stimulates the pancreatic ferments is also present long before birth. The pancreatic secretion is probably capable of acting slightly on starch from the first; but, like the saliva, it cannot be expected to do much in this way till after the sixth month.

Liver.—The liver is relatively large at birth and remains so during early childhood. The bile is first secreted early in intra-uterine life and accumulates in the intestine along with the other constituents of the meconium. It contains a smaller proportion of bile-salts than in adult life, and is less concentrated; but, so far as is known, these differences have no clinical bearing.

Stomach.—At birth the stomach is more tubular than later, owing to the slight degree to which the fundus is developed; and it retains for several weeks the nearly vertical position which characterises it during fœtal life. The action of its muscular wall is relatively feeble.

During the first year, the fundus increases in size more

rapidly than the rest of the organ, and the stomach thus comes to lie even more horizontally than in the adult. The slight development of the fundus in young babies accounts for the small amount their stomachs are able to hold. According to Holt, the average capacity of the infant's stomach is at birth, $1\frac{1}{5}$ oz.; at one month, 2 oz.; at three months, $4\frac{1}{2}$ oz.; at five to six months, $5\frac{3}{4}$ oz.; and at twelve to fourteen months, nearly 9 oz.

Intestine.—In the young infant, the intestine is relatively longer than in the adult. The muscular wall is also feebler, which helps to account for the greater tendency to flatulent distension of the abdomen that little children have. At birth the cæcum is higher up, and more movable than in adult life, and the ascending colon is short. The main peculiarity of the intestine in the new-born infant is the large size of the sigmoid flexure, which at this age is nearly as long as all the rest of the large intestine put together. By the fourth month, the other parts of the colon have grown so much that the sigmoid has nearly assumed its permanent proportion to them (Rotch).

Sucking and its Derangements.

The Act of Sucking.—In the adult, there are two ways of drawing liquids into the mouth.[1]

(a) *Inspiratory Sucking*, in which the suction power comes from the lungs, the buccal cavity being open behind for the time.

(b) *Mouth Sucking*, during which the buccal cavity is closed behind and the active lowering or flattening of the tongue, which forms its floor, causes the indrawing of the liquid.

In the new-born child, the process is one of mouth-sucking, but it differs a little from that in the adult. The infant's tongue, being as yet less mobile and more fixed in its position, as well as relatively larger, plays a less active part; and the lowering of the floor of the mouth is mainly due to vigorous downward movements of the lower jaw. As the child grows older (two to four years) he gradually takes to the adult way of using the tongue in sucking.

[1] L. Auerbach, *Arch. f. Anat. und Physiol.* (Physiol. Abth.), 1888, 59.

For the proper performance of the act of sucking, the lips must be able to close firmly on the nipple, and the pharynx be shut off by the soft palate. The upper respiratory passages must also be free, so that breathing may go on with the mouth shut; and there must be no pain from the act. If any of these conditions is not fulfilled, sucking may be greatly interfered with, and nutrition may consequently suffer. When a baby refuses to suck, we should always endeavour to find out whether this is due to a disinclination for food, or whether it is caused by some local interference with the act of sucking.

It is a striking fact that babies on the breast can breathe and take nourishment at the same time in a way that older children cannot do. This is due to the fact that in them the upper end of the larynx reaches higher and projects upwards behind the soft palate to such an extent that the milk and saliva readily pass round its sides and down the œsophagus without reaching the level of the glottic opening.[1]

As the child grows older and his neck lengthens, the level of the glottic opening becomes lower in relation to the surrounding parts until at last it is below the uvula.

Interference with Sucking may occasionally arise from malformation or disease of the parts involved in the act. Infants with hare-lip and cleft-palate, for example, have great difficulty in taking the breast or bottle at first; but with tact and perseverance some of them learn before very long to suck fairly well. It may be necessary, however, to resort to spoon-feeding or to use a syringe. Any painful condition of the lips, tongue, or palate stops a child sucking; and pain in the fauces often has the same effect. The baby may also refuse the breast or bottle if he has recent nasal obstruction or dyspnœa from pneumonia; for, in either of these cases, he has difficulty in keeping his mouth closed long enough for the process of sucking.

Refusal to take the breast or bottle is more frequently due to general causes, such as debility, dyspepsia, temporary interference with consciousness (as from injury at birth), or mental defect.

Difficulty in Swallowing.—When a new-born child is unable to swallow more than two or three teaspoonfuls of

[1] L. Hasse, *Arch. f. Anat. und Physiol.* (Anat. Abth.), 1905, 328.

fluid and almost immediately returns it, the case is probably one of congenital obliteration of the œsophagus (p. 278).

Another very striking form of difficulty in swallowing is that met with in spasmodic œsophageal stricture. In this rare condition the obstruction varies from time to time and is accompanied by an excessive flow of saliva and mucus (p. 282).

In addition to these rare and serious forms of difficulty in swallowing, a slight functional variety of the symptom is not uncommonly met with in nervous babies who are being given semi-solid food for the first time. It is a purely neurotic symptom and is generally soon overcome by tact and perseverance on the part of the nurse.

Rumination (*Merycism*).—Strong vigorous babies, who habitually drink too much milk from the breast or bottle, often have a way of regurgitating the surplus, which relieves their stomachs and causes them no uneasiness. Regular rumination, though usually only recognised in later life, not very rarely begins in infancy;[1] and, as has been recently pointed out,[2] the nature of the symptom is often misunderstood owing to careless case-taking and it is mistaken for dyspeptic vomiting. As Hess has stated,[3] the habit is associated with a hyper-excitability of the involuntary muscles, and pylorospasm has sometimes been found along with it.

Symptoms.—In mild cases the nature of the symptoms is easily overlooked. The rumination occurs only once or twice in the day and most, if not all, of the food regurgitated is swallowed again. There is therefore no cause for anxiety and the habit is easily cured by careful nursing and feeding. In severe cases, however, a large proportion of the food brought up runs out of the mouth and is lost, so that the baby's nutrition suffers and he becomes pale, wasted, sleepless, and nervous. When the habit has been allowed to become thoroughly established, it is very difficult to cure, and the child may die of inanition. Grulee, indeed, states that more than 25 per cent. of such cases end fatally.

Treatment.—(1) Drugs such as arsenic, bromides, and other

[1] E. M. Brockbank, *Brit. Med. Journ.*, 1907, i., 421.

[2] Freund, *Mitth. a.d. Grenzgeb. d. Med. u. Chir.*, 1903, xi., 325; Grulee, *Amer. Journ. Dis. Child.*, 1917, xiv., 210.

[3] *Amer. Journ. Dis. Child.*, 1914, vii., 184.

sedatives are of little or no use. (2) Changes in the food, also, have no good effect, except that occasionally there is an advantage in thickening the milk to a pulpy consistence with some form of cereal. (3) In one of my hospital cases, the Ward-Sister noticed that the patient (a girl of ten months) always sat up before beginning to regurgitate her food; and the habit stopped very soon when she was kept lying down for some time after every meal. If, as sometimes happens, the child assists the return of the food by putting his fingers into his mouth, he should be made to wear splints or otherwise prevented from bending his elbows. (4) In most cases, the great thing is to treat the child's psychical condition. If a really tactful and intelligent nurse is put in charge, who understands how to divert the baby's attention from himself after each feeding, the habit will soon lose its hold.

Air-Swallowing (*Aerophagia*).—Many, if not all, artificially fed babies normally swallow a certain amount of wind while sucking the bottle, and most of it comes up again easily when it is displaced by the next supply of milk going down. The mothers, therefore, get into the useful habit of raising the child up in the middle of his meal and patting him on the back in order to facilitate this normal eructation.

In weakly babies, air-swallowing is apt to have serious consequences if much practised; for, either from a contraction of the cardiac orifice of the stomach or just from the feebleness of the over-distended organ and the abdominal muscles, the air may be retained in such quantity as to give rise to great distress by its pressure; and it may lead to collapse of the lung. This is a not uncommon cause of sudden death in weakly infants who are not being properly looked after. In some cases the swallowed air causes vomiting.[1] When the distension of the stomach is excessive, a stomach-tube may have to be passed; and recurrence of the condition must be guarded against by the mother frequently holding the baby upright against her chest and patting his back till the wind comes up.

Appetite and Thirst.—It is often difficult, if not impossible, to distinguish hunger from thirst in babies; and it is well to remember that an infant's desire to suck is far

[1] A Lesage, G. Leven, et G. Barret, *La Clinique Infantile*, 1909, vii., i., 13.

oftener due to thirst than to hunger. When we see a baby opening and shutting his parched mouth and straining wistfully after any bottle or cup that is brought near him, this forms an urgent indication for treatment; but boiled water, not milk, should be given. If for any reason fluids cannot be given by mouth, a saline enema (2 oz.) should be administered; and, if that is not retained, subcutaneous saline infusions are indicated. Sometimes an abnormally large appetite in a baby is merely a bad habit induced by habitual over-feeding.

When an infant refuses the bottle, and there is no reason to think that sucking hurts him, the cause is usually to be found in dyspepsia or improper feeding. Disinclination for food is the natural accompaniment of a diminished power of digestion, and with recovery of the digestive power the appetite returns. Obstinate refusal to suck is often a striking symptom in the early stages of pyloric stenosis, when the food is accumulating in the stomach and the child has not yet learned to relieve himself by vomiting (p. 292). Disinclination to take food is often due to an excessive amount of fat in the food, and is soon overcome when less cream is given.

Normal Digestion.

As we have already seen (p. 107), the anatomical capacity of the young infant's stomach is small. There is, however, reason to believe that its physiological capacity is much greater than post-mortem measurements had led us to believe, and that it is neither necessary nor desirable to limit the size of the meal strictly to the quantity that the stomach can hold at one time; for X-ray examinations show that, even during the nursing, a considerable amount of the milk passes into the duodenum. This fact is interesting in relation to the longer intervals between meals which most modern clinicians find advisable.

After the milk enters the stomach, the bulk of its protein is coagulated by the action of the rennet. The curd produced in this way contains the casein and some of the fat, along with calcium and other salts from the whey; while the whey itself contains the remaining constituents of the milk which are soluble in water (salts, sugar, albumin, and globulin).

The whey soon passes into the duodenum; but the curd, if considerable in amount, remains much longer in the stomach. There has been great difference of opinion as to the time it takes for the healthy infant's stomach to empty itself after a meal. According to Morse and Talbot "the stomach digestion lasts in the breast-fed baby from one and a half to two hours; and in the artificially fed baby, three hours"; but it has also been shown that in some babies on the breast the stomach may be empty within an hour. The duration of digestion depends, of course, to some extent on the quantity of food taken.

The opening of the pylorus to let milk into the duodenum depends on the reaction of the stomach contents and on that in the duodenum. On the one hand, acidity of the pyloric end of the stomach predisposes to the pylorus opening, and strong alkalinity to its closure; on the other, alkalinity in the duodenum tends to make the pylorus open and acidity to keep it shut. Should the contents of the pyloric portion of the stomach be strongly acid, therefore, their passage into the duodenum will rapidly inhibit the opening of the pylorus. The cardiac orifice relaxes when the contents of the adjoining portion of the stomach are alkaline, and closes when they are acid. It is probable that solids, such as coagulated casein, have a mechanical action in preventing the opening of the pylorus.

The *protein* in the food is completely disintegrated in the stomach and bowel, and usually it is practically all absorbed from the alimentary canal, and leaves the body through the urine, mostly in the form of urea and ammonia. None of it is found in the motions except when unboiled cow's milk is being given, in which case some of the hard curds may remain undigested.

The infant needs a much larger proportion of protein in his food than the adult, because he must get from it wherewithal to form new tissues, in addition to what he uses in the repair of tissue-waste.

The digestion of *fat*, also, begins in the stomach, though most of it takes place in the bowel. A varying proportion of the fat appears normally in the stools in different forms (*v. infra*). That which is not consumed at once in the body is stored in the liver and subcutaneous tissues.

The fatty element in the milk is the great source of animal heat, and the infant has greater need of heat-producers than the adult, because his body-surface is relatively larger and his loss of heat correspondingly greater. Fat saves nitrogenous waste and increases the body-weight. It is necessary also for the health of the nervous tissues; and, as it assists the absorption of earthy phosphates and other salts from the bowel, it is important for the proper growth of the bones and of the teeth also.[1] The presence of carbohydrate in the food is necessary for the satisfactory metabolism of the fat.

Cream is badly borne by infants with acute disease of the alimentary tract and by those who are wasted as the result of indigestion, also by those who are fevered, and by most infants in very warm weather.

The *accessory food-factors*, which are present largely in the fatty elements of the food and accompany them in their absorption, are believed to be required in relatively larger amounts in children during the period of their rapid growth than in adults.[2]

Milk-sugar, or lactose, is the form of carbohydrate which is present in the milk of all animals, the only difference being in the quantity present. It is less complicated in composition than starch, but more so than glucose which is the only form of carbohydrate that the tissues are able to make immediate use of. It is digested chiefly in the intestine, where it passes through the forms of dextrine and maltose, and finally is absorbed as glucose. No carbohydrate is found in the stools unless an excess of starch has been given. After absorption, the carbohydrate is stored in the form of glycogen in the liver and muscles; and from them it is gradually doled out to the blood. Under various abnormal conditions sugar is excreted in the urine, but this never happens in healthy children.

Sugar is an important source of muscular energy and heat. Lessening of it in the food tends to lower the body temperature. It also assists the action of the protein and favours the metabolism of the fat, and is capable of replacing the latter to some extent; when present in large amount, it has an action in enabling the tissues to retain water, so that it increases the

[1] Mrs Mellanby, *Lancet*, 1918, ii., 767.

[2] J. C. Drummond, *Lancet*, 1918, ii., 482.

weight. Like protein and salts, and unlike fat, it is indispensable to life. When present in full amount, milk-sugar has a laxative effect on the bowel; and when given in a larger proportion than 7 per cent. it is apt to cause diarrhœa, with loose, green, acid stools.

The Mineral Salts are absorbed mainly from the bowel. They are very important in infancy as they are required for the growth of all new cells as well as for that of the skeleton. Those which are not utilised in this way pass out of the body either in the fæces or the urine. When in strong solution, the salts of cow's milk act on the intestinal mucous membrane in such a way as to interfere seriously with the assimilation and metabolism of the fat and sugar in the diet. In young babies, as has been already mentioned, an excess of salts in the food often leads to abnormal retention of fluid in the tissues and to a misleading gain in weight. A too great diminution of the salts interferes with the gain in weight and tends to lower the temperature.

The Water in the food passes through the stomach, and its absorption takes place mainly in the small intestine. Most of it leaves the body through the kidneys; but a considerable proportion also passes off through the lungs and skin and in the fæces. The presence of sufficient salt in the food favours, for the time, the normal retention of water in the body.

Defæcation and its Disorders.

The infant's bowels generally act from two to four times in the day during the first month or two, and once or twice daily after that. The process should, of course, be quite easy and painless. If otherwise, the cause of the discomfort or pain requires investigation.

Scanty and infrequent motions may be due simply to the small amount of food reaching the intestine, as occurs when there is persistent vomiting, or to a variety of other causes (see Constipation, p. 128). Painful defæcation may be due to fissure or other cause of spasm of the rectum or to tenesmus.

Fissure of the Rectum and Rectal Spasm[1].—Anal fissures are by no means rare in infancy, and their occurrence must not

[1] F. Frühwald, *Ueber Mastdarm-Rhagaden und Fissuren in Kindesalter*, Wien, 1896.

be forgotten, for they may give rise to severe and perplexing symptoms. The lesion, if single, is said to be most frequently situated on the posterior wall. In some cases the fissure is easily seen by merely pulling apart the edges of the anal orifice. In others, a small speculum has to be used. In babies a bivalve nasal speculum answers the purpose. Should the rectal mucous membrane be partly prolapsed, as sometimes happens, the fissure may be difficult to find.

Causation.—Two factors are to be recognised in the causation of fissures. On the one hand, there is local weakness due to lesions of the skin and mucous membrane, especially eczema, specific eruptions, or an irritation arising from diarrhœa or thread-worms. The habitual use of suppositories or enemata is apt to cause them. On the other hand, there is the periodic over-distension of the anal ring by hard fæcal masses, which takes place in constipation.

Symptoms.—The first effect of the fissure is spasm of the sphincter ani. This may be brought on only by movement of the bowels, or it may occur at other times also. When the attack comes on, the infant screams and stretches himself straight out with his head back and his thighs extended and pressed closely together, and he seems in severe pain until the spasm passes off. The occurrence of rectal spasm tends greatly to increase the constipation. Defæcation becomes extremely painful and the infant does all he can to postpone it. The longer the motion is retained the larger and harder does it become, and the more painful is its ultimate passage, so that a vicious circle is set up. The motions are often streaked with blood. The frequently recurring, vague, sickening pain which the child suffers soon has a marked effect on his appearance. He becomes haggard, worn, restless, and miserable. The screaming which rectal spasm causes is often mistaken for colic; but, if the child's attitude and behaviour during the attack are watched, there should be no difficulty in recognising its cause.

In some cases the irritation spreads to the nerves of neighbouring parts. The surrounding skin may become tender to the touch, or there may be erections of the penis or spasmodic retention of urine. This last-named symptom should always draw attention to the state of the anal orifice. General irrita-

bility, sleeplessness, night-screaming, and even convulsions, may owe their origin to this small lesion.

Treatment.—The attacks of rectal spasm are generally much relieved by the application of heat to the perineum either in the form of a hot bottle or sponge, or a hot bath.

In the treatment of the fissure the first object to be aimed at is the removal of the constipation by diet, massage, and gentle laxative medicines—if possible without the use of injections or suppositories. If the motions are always soft and the parts round the anus are kept clean and the orifice anointed with a suitable ointment, recovery usually takes place in a short time. The ointment which I have found most useful is one containing ichthyol and tannic acid—a drachm of each to the ounce of vaseline. It should be gently insinuated into the anus on a firmly rolled up pledget of cotton-wool. Should the anal spasms continue, the anus should be stretched under an anæsthetic by the introduction of two fingers. This simple proceeding is generally entirely successful.

In any case of severe and recurrent rectal spasm in which no fissure or other local cause is found, stretching of the sphincter is always advisable. It generally leads to complete and lasting relief.

Tenesmus.—Straining at stool is a common symptom in infancy. It occurs in most cases where the lower end of the bowel is irritated either by a primary local disease or by the passage downwards of abnormal fæces. It may also be due to lesions higher up; it is, for example, an important symptom of intussusception as well as of ordinary prolapse. It may also be due, in older children, to a stone in the bladder or to severe phimosis. The condition, when acute, causes much distress. When chronic, its presence may only be indicated by the child's disinclination to be removed from the chamber after the motion is passed. The symptom generally signifies the presence of a condition which will be benefited by copious irrigations of warm water. If it is severe, a starch enema, containing a few drops of laudanum, may be given.

Rectal Prolapse.—There are two degrees to be observed in cases of prolapse of the rectum. In the slighter form, the prolapse consists of a ring of swollen mucous membrane which protrudes through the anal aperture when the child strains. In the severe variety of the condition, the whole thickness of the

wall of the rectum is involved (Fig. 56), so that the protruding bowel corresponds to the invaginated portion of an intussusception. In these cases, the prolapse is sometimes two or nearly three inches long, and it may remain constantly down.

Causation.—The greater tendency to prolapse which obtains in early life is attributed to many things. For example, the sacrum is less curved in children, the rectum straighter, and the muscles and interstitial tissues in the pelvis weaker and more yielding. The rapid wasting which so readily occurs in infancy is a strong predisposing cause of prolapse. It lessens the

FIG. 56.—Rectal Prolapse in a child of 3 months.

support afforded to the rectum by the ischio-rectal fat before the muscles have time to accommodate themselves to the greater strain thus thrown upon them. The exciting cause is severe and long-continued straining. This may result from constipation, from thread-worms, or from diarrhœa associated with catarrh of the rectum. Extreme phimosis may also lead to it, and in older boys it is sometimes a symptom of vesical calculus.

Symptoms.—When slight in degree the prolapse only occurs during defæcation, and is readily returned. In severe cases, however, any exertion, such as crying and coughing, brings it down, and it is more difficult to return satisfactorily. When

the bowel remains long down, it is apt to become inflamed and ulcerated.

Diagnosis.—There is usually little or no difficulty in recognising the nature of a rectal prolapse. Occasionally, however, a true intussusception is protruded from the anus, and this should always be suspected if there is a history of a recent prolapse setting in acutely with vomiting.

Treatment.—The protruding bowel should be washed with cold water, and gently returned by pressure upwards with an oiled rag. The child should be kept lying for some time after it is returned. The treatment of the morbid condition which gives rise to the straining must be undertaken, and the administration of an iced water enema night and morning is often helpful. To lessen the tendency to recurrence of the prolapse, the child should be encouraged to relieve his bowels lying on his side; and, if he uses the chamber, it should be placed in such a position that his legs are not touching the ground, so that he strains as little as possible. It is of great importance to diet the child carefully and to get him to become fat and firm as soon as may be.

When the tendency to prolapse is so great that protrusion of the bowel occurs apart from defæcation, the patient should be kept lying, and his nates should be held tightly together by means of broad straps of adhesive plaster, which are changed when the bowels move. This is a very effective measure. In severe cases, strychnine has been recommended either as an ointment or in hypodermic injections ($\frac{1}{100}$th of a grain twice daily in a child of two years).

The Fæces.

The Meconium passed during the first two to five days is of a dark greenish-brown colour, of a viscid semi-solid consistence, slightly acid in reaction, and without odour. At birth it is sterile; but, within from eighteen to twenty-four hours, micro-organisms find their way into it, at first through the anus and later through the mouth.

It contains epithelial cells and mucus from the intestine and its colour is due to bile, but the bulk of it is composed of matter derived from the vernix caseosa which the infant has swallowed along with liquor amnii during intra-uterine life.

This is proved by the fact that meconium always contains hairs and squamous epithelial cells which must have been derived from the surface of the child's body.

The motions lose the character of meconium usually after three or four days and become, in turn, dark green, yellowish-green, greenish-yellow, and at last the normal orange yellow colour. They also become more fluid for a time and then gradually regain their semi-solid consistence. The exact time and extent of these changes vary considerably within physiological limits; and, as Southworth has pointed out,[1] much importance need not be attached to a mere atypical colour or consistence of the stools, so long as the baby seems well and is gaining satisfactorily in weight.

Normal Fæces.

In the healthy breast-fed infant, the motions have an orange-yellow colour and a uniform semi-solid consistence; the reaction is slightly acid and they have a somewhat sour but not offensive odour. The stools of a hand-fed infant are similar, provided the food he is taking resembles breast-milk in composition and is being well digested.

Their Composition.—The infant's fæces consist of those food-stuffs which have not been absorbed, of various secondary products of digestion, and of bacteria.

(a) *Unabsorbed Food Stuffs.*—A considerable proportion of the stool is composed of fat. Some of this is present in an unaltered state and has a natural laxative action; much of it is combined with calcium and magnesium salts in the form of soaps, for the process of saponification of the fat is necessary before it can be absorbed in the bowel; and some of it is combined with acids in the form of fatty acids. The soaps are formed when the reaction of the stool is alkaline, and the fatty acids when it is acid. The presence of the soaps increases the consistence of the fæces, while the fatty acids tend to render them more liquid.

The salts of calcium and magnesium are present in large quantity when cows' milk is taken, and they tend to make the stools dry and alkaline.

When the child is being fed on raw cows' milk, the motions

[1] "The Stools of the New-born," *Arch. of Ped.*, 1910, xxvii., 167.

may contain a considerable proportion of protein in the form of hard curds; but when he is on breast-milk or boiled cows' milk no protein is usually present.

No carbohydrate appears in the stools unless an excess of starch is being given.

(b) *Secondary Products of Digestion.*—Certain alkaline products are produced by putrefactive bacteria from unabsorbed proteins higher in the intestine. Others, which are acid, arise from fermentation of carbohydrates—either starch or excess of sugar, or a normal amount of sugar in a damaged intestine. These products of fermentation are lessened by the putrefaction and alkali-formation which follow an increase of the protein in the food.

(c) *Bacteria.*—As much as 16 to 18 per cent. of the fæces may be formed by micro-organisms—many of them probably dead. Under normal circumstances, living bacteria swarm in the lower bowel, while the small intestine is sterile. If the mucous membrane of the small bowel has been damaged, however, either by a too concentrated solution of whey salts or otherwise, the bacteria of the large intestine may spread upwards and flourish more or less in the ileum.

In Starvation, the scanty stools have a dark brownish-green colour like that of meconium, and a slightly stale odour. They may be constipated or loose. They are largely composed of bile, intestinal secretions, and bacteria, and they sometimes contain bile-stained mucus. Motions with these characters are met with in cases of congenital pyloric stenosis when the vomiting is so urgent that little or no food is getting beyond the stomach.

Abnormal Constituents in the Stools.

Under various conditions we meet with abnormal substances in the infant's motions such as casein or fat curds, vegetable tissues, masses of undigested food of other kinds, intestinal sand, medicinal substances, mucus, pus, blood, membranous fragments, and parasites and their ova.

Curds are often found in the stools, and casein curds are to be distinguished from those formed mainly of fat. The *casein curds* are often large, and they are of a white or yellow colour. They are hard and tough, and sink in water; and are

rendered much harder by the addition of formalin; they are insoluble in ether. The *fat curds* are white, yellow, or greenish and small in size. They are readily broken up by pressure and float in water. When acidified and heated they dissolve in ether, and they are not changed in consistence by the action of formalin.

Liquid fat is found in the motions in the very rare congenital disorder of metabolism which is known as "Steatorrhœa."[1]

Unabsorbed Fragments of Vegetable Tissues such as fibres of banana and gritty particles from pears are occasionally found in the motions of older infants who are injudiciously fed. The former are sometimes taken for worms. The pear grit must not be mistaken for **intestinal sand**.[2] This is a very rare constituent of children's stools, and consists in small semi-transparent, gravel-like fragments composed mainly of calcium phosphate. I have known it to occur in the motions of a baby as young as nine months. The causation of the condition is unknown.

Some **medicines**, such as iron, bismuth, cod-liver oil, and petroleum, can often be recognised in the stools.

Mucus is present in small amount in most normal, and in more or less large quantity in many abnormal, motions. When it is present in sufficient amount to be of clinical importance it is easily recognised by the naked eye, though undigested starch may sometimes have a somewhat similar appearance. Its presence may be due to irritation of any part of the intestine. When it comes from the small intestine, the mucus is thoroughly mixed with the fæces, while that from the lower bowel is in larger amount and is more on the surface of the stool.

Pus may be found in considerable quantity in the motions during the later stages of severe colitis and in ulceration of the large intestine.

Blood.—In infants the presence of small quantities of blood in the motions is often of little importance. Streaks of it may be seen in the stools in various forms of diarrhœa, and often also in constipation, especially if there is any ulceration, fissure, or prolapse of the rectum present. Blood and mucus in large quantity, and passed alone with straining, are very characteristic of intussusception; and it is important to remember that, in

[1] A. E. Garrod, *Quart. Journ. Med.*, 1913, vi., 22, 242.

[2] A. E. Garrod, *Trans. Med. Chir. Soc. Lond.*, 1901, lxxxiv., 389.

chronic and incomplete cases of this condition, the passage of blood along with fæces may be almost the only symptom present.

Hæmorrhage from the bowel (melæna neonatorum) is a frequent occurrence in the hæmorrhagic disease of new-born children (p. 409). *Spurious melæna*—that is to say the passage from the bowel of blood which has been sucked from fissures in the mother's nipple or swallowed during an attack of epistaxis—is much oftener met with than true melæna.

Fragments of **membrane** from severe colitis are occasionally met with in infancy.

Worms and their ova are often present in the stools; and, in rare instances in hot weather, the larvæ of certain flies may be passed from the bowel.

Other Characters of the Motions.

The *number* and *size* of the stools vary in health as well as in disease. It is always more important to ascertain the amount of fæces passed in the twenty-four hours than merely to reckon the number of the movements; for the frequency with which the bowel acts in health depends largely on the state of the child's nervous system. A restless lively baby may have three or four normal motions in the day, while one who is placid and contented passes the same amount in one large daily stool.

If the stools are very large, this implies a corresponding diminution in the absorption of nourishment from the alimentary canal, and it is usually accompanied by a serious failure of strength. It occurs when the digestion in the small intestine is much interfered with. When, in a case of diarrhœa, the motions, though frequent, are small in size—as is the case when the lower bowel is the part chiefly involved—the interference with the child's nutrition may be comparatively slight.

The *colour* of the milk fæces, which is normally bright yellow, varies considerably in shade and depth within physiological limits, the exact tint depending on the amount of bilirubin present. It is lighter when the digestion is taking place slowly, consequently the stools of hand-fed babies are often a paler yellow than those of infants who are on the breast.

The colour is generally altered in disease and a change to

some shade of green is very common. This is mostly due to the bilirubin having been replaced by biliverdin. If slight in degree, the change is of little or no importance and is no proof of disease; normal stools often turn green on standing. Green motions may be due to strong acidity or to alkalinity, to the presence of a special ferment or to bacillus pyocyaneus. The addition of nitric acid to a green stool decolorises it if the abnormal tint is due to micro-organisms, and gives the play of colours characteristic of Gmelin's test if it is caused by biliverdin. In starvation, as already mentioned, the motions have usually a dark brownish-green colour. The addition of malt or barley water to the food may also give the stools a slightly brownish tint.

A clay colour of the motions often arises from obstruction of the bile-ducts, but it may only be due to a colourless bile-salt having taken the place of the usual coloured one. A chemical examination is necessary to determine whether bile is present. The presence of a large proportion of soap may also cause clay-coloured or white motions. When the pale colour is due to this cause, the stools are usually hard and dry. When a newly born child's stools are white from the first, this usually depends on congenital obliteration of the bile-ducts, but it may also be caused by obliteration or obstruction of the bowel below the point of their entrance.

The administration of bismuth often turns the stools greenish-black, and iron and charcoal give them a black colour. The darkest motions are those which contain altered blood.

The soft homogeneous *consistence* of properly digested milk-fæces is lost when the child's food is varied, and is more or less changed in most forms of dyspepsia. The presence of much soapy matter renders them dry and hard, and an excess of sugar or cream tends to make them too liquid. In summer diarrhœa they are often composed of almost pure serum.

The *reaction* of the stools is generally more or less acid. An excess of fat increases their acidity, and much protein in the food gives them an alkaline reaction. The very acid motions which are caused by a large excess of carbohydrates in the diet, are a common source of irritation of the skin of the buttocks. The watery motions of summer diarrhœa are distinctly alkaline.

The faint *odour* of the normal motions is often greatly altered in disease. When there is fat indigestion, or when acid fermentation is taking place from an excess of carbohydrates in the food, they have a very sour smell; while the use of raw meat juice or the presence of protein indigestion occasions a varying degree of putrefactive odour.

Microscopic Examination of the Stools.—For ordinary clinical purposes a simple inspection of the motions is usually all that is necessary. Sometimes, however, it is desirable to examine them microscopically also, especially for undigested starch and as to the amount and form of the fat they contain.

For this purpose a small portion of fæcal matter is rubbed up with water and examined unstained for the presence of blood, pus, ova, etc. Another slide is stained for starch-corpuscles with iodine solution (iodine, 2; pot. iod., 4; distilled water, 100 parts); and a third with a saturated alcoholic solution of Sudan iii., which stains neutral fat drops and fatty acids, but leaves the soap crystals unstained. After this slide has been examined under the microscope it is further treated by allowing a drop of glacial acetic acid to run under the cover-glass, thoroughly mixing it with the specimen and then heating it till it begins to simmer, but not enough to make it boil. This changes the soap into neutral fat and fatty acids, which appear as large stained drops and crystallise on cooling. In order to form an idea of the amount of the fat that is present as normal fat, it is necessary to treat another slide with carbol-fuchsin, which stains fatty acids a brilliant red, soaps a dull red, and leaves neutral fat uncoloured.[1]

Some Symptoms of Digestive Derangement in Infancy.

Vomiting as a Physiological Act.—Nature has sought to make up to the baby for his lack of judgment in feeding, and his dependence on others for the choice of his food, by giving him great facility in rejecting from his stomach any meal that is unsuitable in quantity or quality; and the vomiting of unwelcome food may be regarded as to a large extent physiological. Washing-out of the stomach is a much less distressing proceeding to infants than to older people, and it

[1] See Morse and Talbot, *loc. cit.*, 85.

is often most useful in helping them to recover quickly from an indiscretion in diet. In many cases the vomiting of infants is not a serious matter, and it is never to be taken as such if the baby is thriving in spite of its continuance.

Vomiting as a Sign of Disease.—Excessive vomiting, though one of the commonest indications of digestive derangement, is also frequently due to diseases of other systems.

(1) *In acute febrile and infective disease* vomiting is often one of the first symptoms noticed. This is so in pneumonia, in scarlet fever, and some of the other exanthemata, and in some epidemics of influenza. It is also characteristic of uræmia and other renal affections and of acidosis.

(2) In *meningitis* and other *intracranial affections* it is very common, and, whenever we have obstinate and unexplained vomiting, we should remember the possibility of its being cerebral. It may be impossible to discriminate cerebral from dyspeptic vomiting in infants by any special characters, the relation of the symptom to food affording little help owing to the frequency of the feeding.

(3) *Intestinal obstruction* from intussusception, peritonitis, or other local abdominal disease must be borne in mind as a possible cause of vomiting.

(4) *Reflex vomiting* is occasionally met with. It may be due to irritation from worms, to teething, or to ear disease.

(5) In older children, especially girls, *nervous or hysterical vomiting* without local disease occasionally occurs, and a similar condition is not unknown in infants in connection with refusal to take food. In infants, also, rumination sometimes ends in severe vomiting.

(6) Vomiting is a grave symptom in *cardiac dilatation and heart failure*, and is especially to be looked for in cases of diphtheria.

(7) In most cases of *congenital hypertrophy of the pylorus*, and in *pyloric spasm*, vomiting is the most striking symptom.

(8) Continuous vomiting from birth of deeply bile-stained fluid, with bile-stained motions, may be due to partial stenosis of the small intestine with *dilatation of the duodenum.*

(9) A sort of vomiting sometimes occurs, apart from stomach disease, in cases where there is *severe coughing*, the food being brought up by the violence of the cough. This occurs chiefly in whooping-cough.

(10) Generally, however, vomiting is due to *improper feeding*, or to some form of *dyspepsia;* and, when this is so, it is usually accompanied by an abnormal state of the motions, by wasting, and by other indications of digestive derangement. The various conditions under which it is met with and its treatment will be considered later.

Intestinal Flatulence and Colic.—These symptoms frequently occur together. They may be present when there is neither vomiting nor diarrhœa, although they are often associated with these symptoms. *Flatulence in the bowel* may be caused in otherwise healthy infants by the swallowing of wind, but it often arises from fermentation or other change in the intestinal contents with the formation of gas. It is apt to occur when there is too much indigestible matter—such as starch, milk-curd, or fruit—in the food. Severe flatulent distension of the bowel is a common and distressing terminal symptom in abdominal tuberculosis, especially in young infants.

Colic may be due simply to the presence of intestinal flatulence, or of irritating substances arising from chemical decomposition, to the mechanical irritation of scybala in the large intestine, or rarely, to lead-poisoning. It is often complained of in chronic constipation, and is a frequent symptom of some varieties of purpura. It may also be caused reflexly—for example, by cold feet.

Extremely severe recurrent colic occurs in cases in which there is a chronic organic obstruction of the lumen of the bowel. This is most frequently due, in this country, to the cicatrisation of tuberculous ulcers in the bowel or to adhesions. When any condition of the kind is suspected, the abdomen should be carefully watched for the occurrence of "ladder patterns" (p. 782), which indicate the necessity for a surgical operation to relieve the obstruction.

The presence of colic is easily recognised by noting the child's behaviour when an attack comes on. The pain makes him cry; and, during the paroxysms, he flexes the legs on the thighs and the thighs on the abdomen, bending the arms also and clenching the fists. After this has lasted for a short time, some wind passes, and the pain is at once relieved, although it often soon returns.

Although there is generally no difficulty in recognising the

nature of intestinal colic, renal colic may sometimes be mistaken for it. As we have already seen (p. 115), the behaviour of the infant during rectal pain is quite different. Long continued or frequently recurrent abdominal pains are sometimes caused by spinal caries, and these are not infrequently mistaken by the parents for colic.

The *treatment* of abdominal distension from intestinal flatulence consists usually in clearing out the offending contents of the bowel by a copious warm water enema, by castor oil, or by small doses of calomel ($\frac{1}{10}$ gr. every half hour until 1 to 1½ grs. has been given), and by strictly regulating the diet. As too much cows' milk is the commonest cause, the stopping of all milk for a time is generally the most important indication, and it often produces a striking improvement. Salicylate of soda (1 to 2 grs.), an alkaline carminative mixture (Appendix I., Form. 6), or a few doses of pepsin or papain (Form. 7) are also sometimes useful. In cases of abdominal tuberculosis, the symptom may be very difficult to relieve; its chief treatment consists in careful regulation of the diet.

The best immediate treatment for a severe attack of ordinary colic is a dose of castor oil and a large warm water enema or irrigation. A hot poultice or fomentation may also be applied to the abdomen, and the feet warmed. Twenty drops of brandy or a dose of carminative (tinct. carminativæ, 1 minim, glycerini, 5 minims, aq. ad., 1 drm.) may also help to relieve the child. If the bowels are habitually constipated this must be attended to.

In the case of young healthy infants who are swallowing large quantities of wind, atropine (in doses of 1 minim of a 1 to 1000 solution) may be given with each bottle.[1]

In obstinate recurring colic in older babies, small doses of codeine ($\frac{1}{32}$ to $\frac{1}{24}$ gr.) are occasionally useful as a temporary palliative while the diet is being regulated. The alleviation they afford encourages the mother to persevere. When the colic sets in immediately after taking the bottle, ½-drop doses of liq. arsenicalis, before each feed, are often useful.

Diarrhœa.—This term is used for cases in which there is increased peristalsis and consequently abnormally frequent action of the bowels. It is sometimes, however, applied also

[1] Sidney V. Haas, "The Hypertonic Infant," *Amer. Journ. Dis. Child.*, 1918, xv., 5, 323.

to cases in which the motions, though not increased in number, are very abnormal in character.

Diarrhœa, like vomiting, may be in a sense physiological, being the natural effort of a healthy body to get rid of substances which are irritating the bowel and threatening to set up disease. Like vomiting also, it may be caused by various general diseases, although it usually depends either on improper feeding or on some disease of the intestine.

(1) Diarrhœa is a common symptom in *severe toxæmias*, as in scarlet fever, measles, pneumonia, septicæmia, acid-intoxication, and uræmia.

(2) It is sometimes purely *nervous and reflex* in origin—no more organic than sea-sickness. It may, for example, be set up suddenly by a chill or wet feet, or it may arise from emotional causes, or from teething. Lienteric diarrhœa (p. 265) occurs sometimes even in young infants.

(3) Diarrhœa may be due to the *mechanical irritation* of undigested vegetable matters in the child's food, such as vegetable seeds and skins, coarse oatmeal or unchewed pieces of potato or apple, or to intestinal parasites.

(4) In other cases the local irritation, which determines it, is of a *chemical nature*, the commonest cause being the fermentation of carbohydrates in the bowel by acid-forming bacteria. The products of these organisms set up increased peristalsis, the bowel itself not being diseased. Such diarrhœa may follow the addition of too much sugar to the bottle or the giving of contaminated milk. It is characterised by acid, loose, green stools. A somewhat similar type of diarrhœa arises, much less frequently, from putrefaction of the proteins in the bowel, but in it the stools are very different, being alkaline in reaction, watery, brown, and offensive.

(5) Another group is that of the *infectious diarrhœas*, which differ essentially from the last in the fact that, in them, the bowel itself is not merely irritated but is diseased, owing to the action of the micro-organisms which are the cause of the illness (*e.g.*, streptococcus, dysentery bacillus, or gas-bacillus).

(6) Diarrhœa is also a common symptom of ulceration and other *organic diseases* of the intestine.

Constipation.—Constipation is a common and sometimes a very troublesome symptom in babies. It may be said to exist in any case in which the stools are harder, drier, and

less frequent than they should be. It is important, however, to remember that mere infrequency does not constitute constipation if the stools are perfectly normal; and also that some constipated babies have three or four small hard dry motions in the day.

The *causes* of constipation are many and various.

(1) *General Causes.*—In some cases there seems to be a hereditary predisposition as one or both parents are similarly affected. Cretin babies are generally very constipated, and it is possible that scanty thyroid secretion may sometimes play a part in causing this symptom in apparently normal children. Anæmia is another predisposing cause, and pyrexia also generally tends for the time to produce infrequent motions. Obstinate constipation is an almost constant symptom in tuberculous meningitis and some other brain diseases.

(2) *Anatomical Causes.* — It is generally held that the structural peculiarities of the infant's alimentary canal—the greater length of the intestine, especially of the sigmoid and of the mesentery—favour the occurrence of constipation. In a few cases the defective action of the bowels is due to some more definite abnormality. There may, for example, be a congenital constriction of the rectum, or congenital hypertrophy of the colon, or even a tumour of some sort in the pelvis or abdomen.

(3) *Spasm of the Sphincter* from fissure, from the irritation of scybala, or from any other cause, acts strongly in many cases in preventing the regular evacuation of the bowels. "A very tight sphincter is the cause of constipation in a small proportion of nurslings; and before beginning other treatment in such cases the sphincter should be stretched by passing a protected index finger into the rectum."[1] This simple proceeding is often very successful.

The commonest and most important causes of constipation, however, are general atony, improper feeding, and defective training.

(4) *Muscular flabbiness of the bowel and of the abdominal wall* from rickets, debility, and lack of exercise are strongly predisposing causes; and the local weakness which follows acute attacks of colitis often leads to obstinate and prolonged constipation. A habit of constipation is always likely to be lessened by any

[1] C. G. Kerley, *Practice of Pediatrics*, Phila. and Lond., 1914, 236.

therapeutic measure which improves the child's general vigour and tone.

(5) *Dietetic Causes.*—(*a*) A scanty supply of food, either from the breast or the bottle, always tends to the production of small dry motions; and too little fluid may have a similar effect. (*b*) When the food is much diluted and contains too little fat, it is so completely absorbed that too little residue is left to stimulate the colon, and constipation naturally follows. (*c*) Too high a proportion of fat is a frequent cause of constipation, owing to the large amount of soap formed in the bowel leading to dry crumbling stools. (*d*) An excess of protein in the food tends to slow the intestinal peristalsis; and (*e*) a large proportion of calcium and magnesium salts may also have a constipating effect. (*f*) Too much starch, (*g*) too large quantities of boiled milk, and (*h*) too little fruit, vegetables, and meat are other frequent causes of sluggish bowels in older infants.

(6) *Psychical Causes.*—While giving careful attention to the general and local condition of the infant's body and to the composition of his diet, we must not forget that the movement of the bowels like other habits is much influenced by the child's mental processes.[1] The young baby has almost everything done for him by his mother or nurse. Defæcation is one of the very few things he has to do for himself; and, if he is of a neurotic constitution, he will early recognise that any failure in this is a matter of concern to his elders. His perception of this fact, even at a very early age, brings with it the temptation to make a sensation by refusing to do what is expected of him, and this is a frequent contributory cause of constipation.

From the early months of life the infant should be regularly set on the chamber immediately after his morning bottle. When this is done as a routine, the normal action of the bowels generally soon follows as the result of unconscious suggestion, and its performance assumes the characters of a fixed habit. In babies, as in adults, concentration of the mind on this function is rather apt to develop doubt as to whether it can be performed, and so to inhibit its occurrence. Also, if the child realises the strong impression on his seniors that failure to perform this duty produces, the action becomes at once much more difficult to him. For this reason, the question of his difficulty should

[1] H. C. Cameron, *The Nervous Child*, London, 1919, 30 and 80.

never be made much of or spoken about in his presence; and his mother and nurse should aim at suggesting to him in a cheerfully optimistic way that, of course, the normal act will come off all right, and that, if it does not, no one will be much put about. Early training on these lines is very important, and in many cases it is the only thing needed to establish regular habits.

Treatment.—Our measures for the treatment of a case of constipation in a baby must depend on the causes of the condition. The use of drugs is only occasionally essential; in many cases they do nothing but harm.

(1) If the child is *lacking in vigour and tone*, or is anæmic or rickety, these conditions require special care; a laxative iron mixture (Appendix I., Form. 8) and cod-liver oil may be indicated; and skilled massage, if it can be obtained, is very useful.

(2) If *local abnormalities* such as an anal fissure, are present, they call, of course, for special treatment (p. 116).

(3) *Diet.*—The child's food must be adequate in amount, and its constituents present in approximately proper proportions. It must not contain either too little or too much fat. In many cases what is needed is an increase of sugar to make the reaction of the bowel acid and prevent the excessive formation of soap in the motions. In some cases the substitution of malt for cane-sugar (in the form of Mellin's Food) has an excellent effect, and barley or oatmeal water may sometimes be used with advantage in place of plain water.

In older infants more solid food in the diet may be what is needed, or an increase of broths and soups with a lesser quantity of milk. In other cases oat-flour or oatmeal may advantageously take the place of more constipating varieties of farinaceous food. In young babies the administration of a teaspoonful or two of orange or prune juice twice daily, or dilution of the milk with water in which vegetables have been boiled, are sometimes useful measures; while in the older ones, larger amounts of these things, or apple sauce, or some form of vegetable pulp (carrot or spinach) may often be given with good results.

(4) *Medicines.*—Laxatives should not be used regularly for long periods in infants. Their chief value is that they can be made to assist in inducing the baby to form regular habits.

In atonic infants small doses of tincture of nux vomica (1 minim) or of belladonna (3 minims) are often helpful, and milk of magnesia (1 to 2 drms.), phosphate of soda (10 to 60 grs.), phenolphthalein, cascara, and liquid paraffin may, in different ways, exert a useful effect in the treatment of constipation by rendering the motions softer and therefore more easily passed. At the same time they increase the natural stimulation of the bowel which the baby has hitherto got into the habit of ignoring. Such purgatives as calomel and castor oil should not be given regularly for constipation.

(5) *Local Mechanical Treatment.*—Local stimulation of the rectum by the insertion into it of an oiled roll of paper, a piece of soap, or a gluten or glycerine suppository, is usually efficacious in producing a motion. But if a device of this kind is made use of habitually for any length of time, the infant soon gets to depend on it entirely and to ignore Nature's gentler intimations.

In obstinate cases, a small soap and water enema, or the injection of a teaspoonful of glycerine, may at times be advisable; but the habitual use either of suppositories or enemata (especially those containing glycerine) is apt in time to set up irritation of the rectal mucous membrane, and sometimes causes a fissure. Occasionally, also, the injection of ½ to 1 oz. of olive oil, gently introduced into the bowel at bedtime (through a catheter) and retained till morning, is of great benefit in the early treatment of bad cases.

(6) *Psychical Treatment.* — The frequent importance of suggestion in the prevention and treatment of constipation in infancy has already been sufficiently emphasised.

Constipation in older children will be considered in Chap. XII.

CHAPTER VII

ON BREAST FEEDING

On Human Milk, its Composition and Characters.

THE **colostrum** which the breasts supply in small amount to the infant during the first few days shows a higher percentage of proteid and salts than the ordinary breast milk, and has an alkaline reaction. It is usually believed to exert a laxative effect on the bowels; and it has been shown to possess a greater opsonic power for various pathogenic organisms than the milk which is secreted later. There can be no doubt that it is good for the child's health.

In considering the **composition** of human milk, we must remember that, like other secretions, it varies from time to time, even during the course of the day. Its variations do not disagree with the nursing infant. Indeed, it is probable that the mother's breasts vary their secretion to some extent to meet the wants of the baby, as the digestive organs modify the character and amount of their juices according to the kind of food taken. It has been shown by Chapin[1] that the mother's milk has an important function in developing the digestive organs of the growing child so as to fit them for their future diet.

The normal variations of breast-milk, however, are confined within certain limits, and it is of importance to know the average composition and characters. In order to remember and appreciate these, we may compare them, one by one, with those of cows' milk with which we are more familiar. The

[1] H. D. Chapin, *Med. Rec.*, 12th Dec. 1903, 921.

average composition of the two may be given as follows (Holt):—

	Cows' Milk.	Human Milk.	Common Healthy Variations in Human Milk.
	Per cent.	Per cent.	Per cent.
Water	86 to 87	88·05	89·82 to 85·50
Fat	4·00	3·50	3·00 „ 5·00
Proteins . . .	3·50	1·25	1·00 „ 2·25
Milk sugar . . .	4·50	7·00	6·00 „ 7·00
Mineral salts . .	0·75	0·20	0·18 „ 0·25

The constituents of the two kinds of milk differ not only in percentage composition but also, to some extent, in chemical and physical characters. A few facts regarding the different components may be mentioned.

In the two kinds of milk the fat differs little in amount, but that in human milk contains more oleic acid, has a lower melting point, and is in a state of finer sub-division. These characters make it more easy to digest. The cream, as we have already seen, is excreted as neutral fat, fatty acids, and soaps. In healthy breast babies, about 20 per cent. of the fæces may be composed of neutral fat which acts as a natural laxative.

In both kinds of milk, the protein element consists in a mixture of two substances—casein (or caseinogen) which is curdled by acids and by rennet and not by boiling; and lactalbumin which is precipitated on boiling but not on the addition of acids or rennet. In human milk, the casein is said to be to the lactalbumin, roughly, in the proportion of 1 to 2; while in cows' milk, the proportion is something like 4 to 1. This results in the amount of curd in the cows' milk being something like five times as bulky as that of a similar quantity of human milk.

Cows' milk contains a much larger proportion of mineral salts than human milk; the calcium phosphate, for example, being four times as much in the former as in the latter. In human milk, the phosphorus is present almost entirely in organic compounds, while half of that in the cows' milk is in inorganic combinations.

Human milk is amphoteric in **reaction**—slightly alkaline to

litmus and acid to phenolphthalein. Cows' milk, by the time it is available for feeding purposes, is always distinctly acid.

Human milk is practically sterile as it leaves the nipple. Cows' milk, on the other hand, when delivered for use, always contains a large number of bacteria of different kinds.

A very important point is that the milk of healthy women who are properly fed contains, in abundance, the accessory food factors which are required for the infant's growth and nutrition. It has therefore antiscorbutic and antirachitic properties so that children fed on it do not develop scurvy or rickets.

Breast Feeding.

During the first seven to nine months of a child's life, he should draw his nourishment solely from his mother's breasts; and, till the end of the tenth or even twelfth month, if all goes well, the breast-milk should form the main part of his food. The mother's milk is the most digestible as well as the most perfectly nourishing food a child can have; and when a delicate baby is deprived of breast-milk and put on the bottle, he is thereby exposed to great additional risks; this should therefore never be done without careful consideration. If the child is strong, it is less important; but if he is especially weakly (*e.g.* atrophied or syphilitic), breast-feeding often gives him his only chance of life.

Disinclination to Nurse.—In many instances the well-to-do mother does not nurse her baby, simply because she is unwilling to have the trouble of doing so; and the poor mother because she does not wish to be prevented from going out to work. In both cases, this state of things is probably encouraged by ignorance of the extent of the danger to which loss of breast-feeding exposes the child, and to a mistaken idea of the satisfactoriness of feeding by hand. Not only are breast babies stronger and better developed than those who are bottle-fed, but they are also much better able to resist disease. It has been found that among the poor the mortality of hand-fed infants is about six times that of babies on the breast; and, also, that among those who are fed artificially by strangers, nearly twice as many die as among those to whom the bottle is given by their own mother.

Inability to Nurse.—Numerous investigations carried out in Continental cities have shown that the proportion of healthy

women in the working classes who cannot suckle their infants, when the process is properly supervised, is exceedingly small. In practice here, however, we find a considerable number of healthy mothers, especially among the leisured classes, quite unable to provide breast-milk for their own babies, however anxious they are to do so. In America there seem to be even more mothers in this position. It does not, however, follow that, because a mother cannot nurse her first baby, she will necessarily fail in the case of subsequent children.

In many of the mothers, also, who are able to nurse, the milk ceases too soon. This may sometimes be accounted for by the child not emptying the breast thoroughly at each feed because it is given him at such short intervals that he has not time to get properly hungry between times; and, with languid sucking, the breast lacks its normal stimulus, and its function ceases. A high percentage of cream in the mother's milk may act in a similar way owing to its lessening the child's appetite.

Contra-indications to Breast Feeding. — Now and then nursing has to be forbidden because the mother is thought to be so delicate that the additional strain which it causes would be too much for her. This may be so, but in deciding the question we must bear in mind that breast-feeding is an entirely physiological process, and that many weakly mothers are never so well as when they are nursing. Breast feeding should not be allowed if the mother has pulmonary tuberculosis, as the close contact which nursing implies exposes the baby to very serious risk of infection with that disease. Further, the mother may have to give up nursing owing to an abscess of the breast, cracked nipples, or some other local or general disease, or because the baby is unable to suck owing to debility or to some deformity of the mouth or lips. In such cases an attempt should always be made to draw the milk off for him as long as the supply lasts and to give it with a spoon, dropper, or tube. Sometimes as he gets stronger he learns to take the breast quite well.

General Considerations and Practical Details regarding Nursing. — As has already been indicated, there are often difficulties in getting the process of breast-feeding set agoing; and sometimes much tact and perseverance are required. If these are exercised, many mothers, who have seemed at first to be unable to nurse, will do so perfectly well.

One common difficulty is that the milk is sometimes long in coming. There are two ways in which the secretion of milk becomes established under normal circumstances. In some cases it develops slowly, and gradually increases; in others, after a period during which only a little is secreted, there is a sudden profuse flow. We should never, therefore, give up our endeavours until we have allowed plenty of time for this flow to take place. In some instances it occurs within the first two days, oftener on the third day, oftener still not till the fourth, and not very rarely only on the fifth day. Its appearance is encouraged by the breasts being thoroughly emptied. With perseverance, the mother's own baby can usually be got to do this; but, if he fails, it is a good plan, if possible, to call in the services of an older and stronger infant whose vigorous sucking will supply the necessary stimulus to the breasts. When the mother is able to leave her bed early and go about her usual work, as is much oftener allowed nowadays than it used to be, this may have a good effect in starting the full flow of milk.

If the mother is only able to nurse for a few weeks or months, it is generally altogether good for the child that she should do so, as it tides him over the most difficult time for his digestion. This is advisable, even if the breast-milk has to be supplemented by bottle-feeding. Far from the two kinds of milk disagreeing with one another, as some used to think, the mother's milk is found decidedly to help the digestion of the other food. Even when the nipples are too small or too sore at first, these difficulties can often be got over by care and patience and the use of a nipple-shield; and the nursing, once begun, may be quite successful.

Beginning Nursing.—The baby should be put to the breast within six to twelve hours of birth, and again every six hours during the first twenty-four, and every four hours on the second day. As the milk begins to come, the intervals may be shortened. During the first twenty-four hours the baby only gets a teaspoonful or two of colostrum; and in the second day not more than 2 or 3 oz. It is evident, therefore, that Nature does not intend him to have almost any food during these days. Indeed, it is found that even if the very little he gets from his mother is freely supplemented by bottle-feeding, it does not usually prevent the normal, physiological loss of weight occurring in the first few days (p. 14) or do him any

good in other ways. He is, however, all the better of having a few teaspoonfuls of boiled water every two hours to relieve thirst and favour the action of the kidneys. If a little sugar is added to the water it may make the child take it more readily, but there is no proof that it is a useful addition in other ways.

If, by the third or fourth day, there is no milk in the breasts, a couple of teaspoonfuls of a weak mixture of milk and water may be given. It should not be much more than this, for the baby's digestion is very easily upset at this stage if he gets more than he really needs. After a day or so, the feed may be increased to half an ounce and then to an ounce.

The colostrum seems to have a natural laxative effect on the baby. If, by the end of the first twenty-four hours, there has been no action of the bowels, it is generally well to administer a teaspoonful of castor-oil to clear out the meconium, because its retention occasionally gives rise to nervous symptoms.

It is important that the child should be put to the breast regularly and at the same intervals; but no hard and fast rule as to the length of these can be laid down. They may have to be varied according to the child's size, vigour, and appetite. It may, however, be said, in a general way, that for the first week the baby should be put to the breast every two hours during the day and every four at night—that is ten times in twenty-four hours; and that for the next three weeks 2½ hour intervals (*i.e.*, eight feeds in the day) are better. After the first four weeks the intervals in the daytime should last three hours, and those at night should be gradually lengthened also. At, and after, the age of six months he should have six feeds during the day and none at night; and they should be decreased to five in two or three months' time.

In nursing, the breasts should be used alternately; and the baby generally takes about twenty minutes to a meal, though sometimes a strong infant gets all he needs in ten or fifteen minutes. If the child takes more than half an hour, or falls asleep while at the breast, there is something wrong; either the baby is weakly or there is too little milk for him.

Care of the Nipples.—Towards the end of pregnancy the mother's nipples should be gently manipulated and drawn out so as to prepare them for nursing. When lactation begins

they must be carefully washed and dried after each nursing, and methylated spirit may be applied to harden them. If cracks appear they should be treated with a simple ointment (Appendix I., Form. 9) and a nipple shield used during nursing. If the secretion of milk is threatening to fail, it may sometimes be re-established by emptying the breasts completely with a breast-pump.

Defects in Breast-Feeding.—When the breast-milk is scanty this may be evident from the baby's condition and behaviour; but the only way to ascertain how much he is really getting from the breasts is to weigh him, or his mother, regularly before and after each feed for twenty-four hours. When the breast-milk is not sufficient in amount it should, as already said, be supplemented by artificial feeding.

If the secretion of milk is too profuse, the child will bring up some of it shortly after each nursing, and he may have too many stools.

The question as to whether the composition of the milk is satisfactory is best determined by the condition and behaviour of the baby. If he is satisfied and is gaining in weight and vigour, all is well. The analysis of a sample or two of the milk is not of much assistance. Sometimes a milk which seems quite unsuitable on analysis, is found in practice to agree perfectly well.

If the baby is thriving properly, his stools should be normal in appearance and consistence; but, in breast-babies as in older children, the appearance of well-being of the child is of far more importance than the look of the motions, and no baby should be weaned merely because his stools seem abnormal.

When a baby is not thriving on apparently normal breast-milk, this is sometimes due to outside causes. Perhaps he is being excited by being played with too much, or he is having too little sleep or too little fresh air, or he is not being kept warm enough.

Sometimes the want of thriving is due to abnormalities in the composition of the milk. If the child has indigestion owing to too much protein or fat in the milk, there will be colic, vomiting, or abnormal stools. Excess of fat will appear in the motions as soft yellow curds, and too much protein may cause brownish slimy stools.

Attention has recently been directed to another possible

cause of a lowered condition of health in breast-fed babies which is probably sometimes of great importance, especially among the poor. This is a defective composition of the mother's diet. We know from the results of experimental research that the nursing mother depends on her food supply for the accessory food factors with which she has to provide her child. It is therefore of vital importance that her food, during pregnancy and lactation, should contain an adequate amount of these substances. If it does not, two things are likely to happen. First, the mother's own health suffers, sooner or later, because a large proportion of the accessory food factors she is taking passes into her milk; and, secondly, the amount of them in the milk being still insufficient for the child's needs, he also may suffer from malnutrition and show a subnormal resistance to disease.[1]

Modification of the Breast-Milk.—The best way to increase a scanty supply of breast-milk is to see that the breasts are thoroughly emptied at each nursing. If this is done, more milk will be produced, while if the breast is only half emptied its secretion will tend to lessen. The secretion of milk is also favoured by the mother's having a liberal diet with plenty of fluids, and leading a normal, healthy life. No excess in feeding or in the amount of liquids taken should be allowed.

Sometimes the fault in the milk consists in its being too rich either in proteins only or in all its important constituents. The commonest cause of excessive proteins is nervous excitability of the mother. This is often not amenable to treatment. In some instances, however, where the nervousness is largely due to preventable causes—for example, when a mother is worrying very much at the idea that she will not be able to nurse her baby—it may be possible to reassure her to such an extent that her milk resumes its normal characters, and all goes well.

When the excess in the solids of the milk is due to the mother indulging in too much or too rich food, or not taking enough exercise, a simpler diet and more active life, short of exhaustion, may reduce their amount. They may be further lessened by increasing the intervals between the nursings.

[1] J. C. Drummond, *Lancet*, 1918, ii., 482. See also Hess and Unger, "The Diet of the Negro Mother in New York City," *Journ. Am. Med. Assoc.*, 30th March 1918, lxx., 900.

If exhaustion or too little food are the causes of a high protein percentage, as often happens among the poor, rest and a more liberal diet may set things right.

If the defect in the milk is a low percentage of fat, the mere increase of fat in the mother's diet will not change this unless she herself has been underfed, and is needing an increase of fat and of its accompanying accessory food factors for her own health. If her diet is lacking in protein, a more nitrogenous diet will increase the cream in her milk. Generally the best way to increase the fat in the baby's feeds is to give him a small teaspoonful of cream before or during each nursing.

The proportion of sugar in the milk does not often vary much, and it cannot be increased by changing the mother's diet.

When the breast-feeding has to be supplemented, it is usually advisable that the number of nursings should not be diminished, and that the extra food should be given each time after the breast and not apart from it.

Weaning.—A child should not be taken off the breast before the usual time except reluctantly and for very sufficient reasons. The reappearance of menstruation does not usually make weaning necessary or desirable, for in most cases the baby is not upset by its onset; and, even if he ceases to gain weight for the time and has colic and undigested stools, this need not do him much harm, and he can be hand-fed for the few days that it lasts.

If pregnancy occurs, however, weaning is always to be recommended; and also if the mother takes any serious illness, even if the secretion of milk does not come to an end.

Under ordinary conditions, the baby should be weaned when he is between ten and twelve months old. By this time he needs other food than milk. In warm climates it is usual to advise against the child being taken off the breast during the heat of summer, unless great care in the details of hand-feeding can be guaranteed.

Weaning should always if possible take place slowly for the sake of the mother as well as for that of the child. It is easier for the baby if he has been long accustomed to take one bottle a day while on the breast; and this practice is good for the mother also, as it allows her more freedom and encourages her to persevere with the nursing.

When babies are weaned early, they should be given the

artificial food from a bottle, but older infants should have it from a cup or spoon. To begin with, the food should be rather weaker than would be taken by a bottle-fed baby of the same age, so as to lessen the risk of indigestion from the change.

Wet-Nursing.—When the mother is unable to suckle her child, she must either get a wet-nurse or begin hand-feeding. From a theoretical point of view, the former plan is far the best; but, for various practical reasons, wet-nurses are rarely employed nowadays in this country for healthy children. They are not only difficult to find and expensive to keep, but the circumstances which induce them to offer their services are often such as to render them undesirable inmates of a house.

While wet-nurses can only occasionally be used, however, it must always be remembered that no form of artificial feeding, however skilfully planned and carefully carried out, is nearly so good for weakly children as suitable wet-nursing. Therefore, although wet-nursing is usually unnecessary in ordinary cases, many infants who are dying of atrophy, or from the exhaustion caused by severe diarrhœa or other disease, may be saved by wet-nursing and by nothing else. Where the infant is too weak to be able to draw the milk from the wet-nurse's breast, it may be taken off for him by a breast-pump and given through a bottle or with a syringe.

It is often a good plan to get the wet-nurse to bring her own baby with her, because he may be a great help in keeping up the secretion of milk by thoroughly emptying the breasts. If there is proper supervision, there should be no danger of his being cared for at the expense of the foster child. It is always well to have the Wassermann test applied to the wet-nurse in addition to having her and her baby thoroughly examined, as an infected woman may present no signs of syphilis detectable on ordinary examination.

CHAPTER VIII

ON HAND-FEEDING

THERE is probably no more important subject in the whole range of therapeutics than the artificial feeding of infants, for there is no other by which, if properly carried out, more lives can be saved, and certainly there are few sorts of treatment the mismanagement of which has such disastrous results. Careful feeding during the early weeks and months of life prevents a large proportion of the diseases from which babies die, for it not only supplies them with the nourishment they need to grow and develop normally, but also gives them a store of strength by which they are able to resist the attacks of pathogenic organisms and other morbid influences, both at the time and in later childhood. If no mistakes were made in feeding babies a very large part of our infant mortality would come to an end.

Infant feeding is a large and complicated subject, and it is not easy to deal with it satisfactorily within the limits of a text-book article.[1] Of late years, medical literature has been flooded with innumerable new facts regarding the digestion and feeding of babies. Some of these are of great value, but with regard to others it is still impossible to say whether they are likely to prove of any real importance in practice.

Infant feeding requires much practical as well as text-book study, and one cannot too strongly commend a close attention to its results—both when it is wisely and unwisely practised—in the out-patient department of the children's hospitals and in private practice.

[1] For a full consideration of the subject, the reader is recommended to consult *Diseases of Nutrition and Infant Feeding*, by Morse and Talbot (Macmillan), 1915, or the section on Nutrition in Dr Holt's *Diseases of Infancy and Childhood*, 6th edit. (Appleton), 1911.

Choice of a Substitute for Breast-Milk.

When a baby cannot have his mother's milk or that of a wet-nurse, we must try to provide him with what will be as nearly as possible equivalent to breast-milk. Our chief guide in this matter is to be found in a study of the composition of human milk and the conditions under which Nature supplies it. These have been considered in the last chapter. Human milk, as we have seen, cannot be exactly imitated. Fortunately, however, the healthy baby's digestion has an extraordinary power of adapting itself so as to deal successfully, after a little practice, with a diet which is far from being ideal. In the case of weakly infants, the problem is much more difficult; and in them we may have a great deal of trouble to find anything sufficiently like breast-milk to be satisfactorily digested.

When we study the literature to ascertain what are the *essential qualities* which make breast-milk so much the best food for babies, and which must therefore be imitated as far as possible in hand-feeding, we find that widely different opinions have been held on this question. To some, human milk is, first of all, a food of a definite percentage composition, and its place can only be satisfactorily taken by a mixture which contains protein, fat, sugar, and salts in approximately correct proportions. To others, a close resemblance in the chemical and physical properties of the solids in the food—especially of the proteins—is the main thing. To others again, human milk is above all a sterile fluid, and their main requirement is that its substitute should be thoroughly sterilised. Lastly, there are some who are chiefly impressed by the fact that fresh milk is "a living fluid" subtly blended in Nature's laboratory, and the main problem to their way of thinking is that its delicate combinations should not be disturbed by dilution or heating, or any other manipulations that can be avoided. This hypothesis seems a sort of foreshadowing of the latest views on the importance of accessory food-stuffs in the infant's diet.

It is worthy of note that advocates of all these different points of view have claimed—often with good reason—habitual success for their particular way of feeding; and that they have believed their success to have been due mainly to their methods. They have also sometimes been inclined to regard those who

differed from them as the victims of erroneous observation. To the puzzled student of the subject who observes the results of various modes of feeding babies, the principles of which are so different as to seem almost contradictory, and finds that these do not apparently vary very much, *provided the practical details are carefully carried out*, the position is perplexing.

It is probable that the views on infant-feeding will continue to change, and that new and better methods will be discovered from time to time, as knowledge and experience increase. In the meantime it is well to keep a warm appreciation of all proved facts of the wards and of the laboratory, and an open and hospitable mind to all theories, new and old, but especially to practise keen, critical, and patient observation of results. When one observes the large measure of success which is attained by some intelligent and experienced, though quite unscientific, nurses and ward sisters, one can scarcely avoid the conclusion that the hand-feeding of most babies depends for its success fully as much on art as on science. In the case of delicate infants and those who have recently suffered from illness, careful regulation of the details of the diet is absolutely necessary.

Two things must be remembered in beginning and carrying on the treatment of a baby whose bottle is not agreeing with him. The first of these is the importance of *close attention to the practical details of feeding*. When a previously healthy child is not thriving as he should, this may be, and often is, due to a want of careful planning of his diet. Far oftener, however, it is simply owing to *some of the well-known common-sense rules as to cleanliness, regularity, moderation, and carefulness having been habitually overlooked or neglected.* It is a common experience to find that a baby flourishes at once in the care of a trained nurse on a mixture which had failed to agree while his inexperienced mother was looking after him.

The other point is the *need for patience* in hand-feeding. It is, of course, quite necessary that the food given should be such that, if digested well, it will nourish the child satisfactorily. It is not necessary that it should be digested fully from the first; and, if the baby only makes slow progress for the first week or two, this is no sufficient reason for making a hurried change to a weaker food. We must always bear in mind that most infants have a surprising capacity of adapting their powers of

digestion to a new food, and time must be allowed for this to take place. A baby who is only gaining 1 or 2 oz. in the first week will often be laying on 7 or 8 oz. by the third or fourth.

Cows' Milk.

Fresh cows' milk is certainly far the best, as it is the most used substitute for the mother's milk; and it may be given undiluted, diluted and modified, citrated, or peptonised. The mixed milk of a good dairy is better than that of "one cow"; for the one cow may be unhealthy, however sleek and comely she appears; and she may be an injudicious feeder. We must also remember that the one cow's milk varies much more from day to day in the proportions of fat and other solids which it contains than does the mixed milk of a dairy.

One of the greatest difficulties in the hand-feeding of infants in this country is that it is rarely possible to procure a supply of fresh cows' milk which does not contain a large proportion of undesirable impurities. If you filter a few specimens from an ordinary dairy and observe the amount of epithelial debris, hairs, and fæcal matter in the filtrate, you will not be inclined to question this statement. In such milk, bacteria of many kinds abound. Some of these ferment the milk-sugar and produce lactic acid; others attack the proteins and produce putrefaction; and, occasionally, the specific organisms of tuberculosis, typhoid fever, and other infectious diseases are present also. There can be no doubt that the best plan is to arrange, as they do now in many places in America, for a regular supply of standardised pure milk free from tuberculosis and other forms of contamination. When such a supply of milk can be procured, it may be given fresh and unsterilised, and it is altogether preferable to dried or condensed milk or to proprietary foods, and also to untrustworthy milk that has been sterilised by heat. Fresh milk contains accessory food factors that are essential to perfect growth and development, and these are apt to be lost to some extent when the milk is subjected to prolonged or excessive heating in the process of drying, condensing, or prolonged sterilisation. Experience, however, has shown that no harm is done in this respect by the simple, rapid sterilisation by boiling or pasteurisation of fresh milk just before use, although *repeated* raising of the milk to a high temperature

and keeping it long after it is boiled interfere very greatly with its value as a satisfactory infants' food.

Undiluted Sterilised Milk.—It used to be stated that only in exceptional instances could a young baby digest undiluted cows' milk. It has, however, been abundantly shown by Budin [1] and others that pure milk agrees quite well with most healthy infants, provided it is, in the first place, "sterilised" (*i.e.*, kept at a temperature of 212° for forty-five minutes) before use; and, in the second, that the quantity given is strictly limited—not more than one-tenth of the child's weight of milk being taken in twenty-four hours.

This method of feeding often gives excellent results when used, from birth, in healthy infants; and it has the obvious advantage of being much less troublesome to carry out than most of the other methods recommended. It is rare, however, to find sickly babies that can tolerate it, and there are also healthy infants with whom it does not agree. The experience of this method of infant feeding in France and in this country has shown that, if the milk used is quite fresh and good, infantile scurvy practically never occurs.

Modification of Cows' Milk.—Although undiluted milk properly given is often quite successful, it is generally found advisable to modify the baby's milk by dilution and the addition of sugar and cream, as well as by sterilising it. Our aim in modifying the milk is to render its various constituents approximately similar in amount to those in human milk. It might be thought that a mixture of cows' milk diluted until the proportion of protein is the same as that in mother's milk (1·25 per cent.), and with cream and sugar added in sufficient amount to raise their percentage to 3·5 and 7 respectively, ought to agree perfectly; but in practice, though such a mixture may be chemically similar to human milk, it is not found to be nearly as digestible. Only babies with a strong digestion can utilise the cream of cows' milk in the same proportion as that in their mother's milk.

Protein.—As cows' milk contains twice or three times too much protein, it has at first to be diluted with equal parts, or even with twice as much water if it is to be made like mothers' milk in this particular. This proportion may be gradually increased until, at eight months, two parts of milk

[1] Budin, *The Nursling*, translated by W. J. Maloney, London, 1907.

are given to one of water, and pure milk by the end of the first year.

Fat.—As already mentioned, it is usually found that the baby cannot digest the cream of cows' milk in the proportion of 4 per cent. A smaller amount must therefore be given. This is usually sufficient for his nourishment, as the child is able to use some of the extra sugar in the mixture to supplement the deficient amount of fat. A practical difficulty which we meet with in the addition of cream is that, unless every specimen used is analysed, we are ignorant of the exact amount of fat we are giving, for the "cream" sold in the dairy may contain any proportion from 10 to 50 per cent. of fat. This difficulty, however, is not so serious as it might appear at first sight; for, if one or two samples of the cream are analysed, it is reasonable to suppose that succeeding specimens from the same dairy will be approximately similar in composition; and the child's digestion may usually be trusted not to be greatly disturbed by slight differences. It is often convenient to use what is called "top-milk" in infant feeding—that is to say the upper portion of a sample of milk which has been allowed to stand for some hours. It is found that when 30 oz. of cows' milk with 4 per cent. cream is allowed to settle for six hours, the upper 16 oz. (removed, preferably by a spoon or special dipper) contain 7 per cent. of cream, and the upper 10 oz. 10 per cent. Ordinary "gravity cream" contains about 16 per cent. of fat. Samples of cream with very high percentages of fat are prepared by centrifuging the milk.

Sugar.—Either cane-sugar, milk-sugar, or malt-sugar may be added to the bottle to increase the proportion of carbohydrate; and generally they all do quite well. Milk-sugar, however, is said to keep less well than the others, and it should not be used unless it is got from a trustworthy source. An ordinary teaspoonful of milk-sugar, levelled with a knife, weighs about 75 grs., and, when dissolved in 2 oz. of water, gives approximately a 5 per cent. solution. The greater sweetness which cane-sugar imparts to the bottle is rather a drawback to its use, for it tends to excite an unnatural craving which may lead later to the child being discontented unless his food is sweetened to an unwholesome extent. In some infants a sufficient amount of sugar—especially if it is malt-sugar—is helpful in the regulation of the bowels.

Salts.—Mineral salts—especially the phosphates of calcium and magnesium—are more important in the infant's diet than in that of the adult, because they are required for the rapid growth of the bones and of the body-cells generally. What matters, however, is not the amount of the salts but the extent to which the child's digestion is able to absorb and utilise them. Cows' milk contains about four times as much calcium phosphate as human milk, and yet the infant may not absorb from it sufficient lime for his needs. It is found that under certain circumstances an excess of calcium and other salts in the food may act on the cells of the intestinal mucous membrane in such a way as to interfere with the absorption and metabolism of the fat and sugar in the food.

Water.—The water in the milk serves to dissolve and suspend the other food-stuffs and to encourage elimination. The infant requires about five times as much fluid for his size as the adult. Plain boiled water is generally used, but it has been found empirically that, in some cases, barley water, *when properly prepared*, is a useful substitute and seems to render the milk more easily digested. Barley water is not difficult to make (Appendix J), but it must be prepared twice a day as it is apt to turn sour if kept more than twelve hours. As it only contains about ·39 per cent. of starch when made in the usual way, it is to be regarded merely as a diluent and not as an important addition to the nutritive properties of the food.

Alkali.—It has long been customary to add an alkali to the baby's bottle to neutralise the acidity of the cows' milk. For this purpose lime-water was usually preferred and it was given in the proportion of $\frac{1}{16}$ to $\frac{1}{8}$ of the mixture, and a solution of bicarbonate of soda (2 grs. to 1 oz.) was sometimes used instead in the same proportions. In choosing lime-water many have thought that they were doing something to favour the growth of the bones and to prevent the occurrence of rickets. It is now known that this was a mistake, for none of the lime in the lime-water can be utilised in the body in this way and, in any case, what the rickety child needs is not more lime in his food but the power to make proper use of what is there already.

Modern authorities are inclined to regard the habitual use of lime-water as unnecessary and undesirable in the feeding

of healthy infants. There can, however, be no doubt that many infants fed on the older formulæ containing a large proportion of it did extremely well, just as many do on definitely alkaline feeds of citrated milk.

Sterilisation.—Absolute sterilisation of milk is impracticable, but fortunately the organisms which it is most important to destroy are rendered inert by a temperature considerably below 212° F.; and for practical purposes it is sufficient that the milk mixture should be raised for a minute or two to the boiling point. It is extremely important that, after heating, the milk should be rapidly cooled either on ice or in cold running water, and that, afterwards, it should be carefully protected from aerial contamination. The vessel containing the milk to be heated should always be placed inside another pan containing water. A double saucepan is useful for this, or a jar inside an ordinary saucepan.

Prolonged heating of the milk to 212° F. (for forty minutes in a Soxhlet's steriliser) is not now usually considered necessary, but it is certain that many babies thrive very well on milk treated in this way, and that, if the milk is fresh, scurvy is not produced.

Pasteurisation.—The raising of the temperature of the milk to 160° F. and keeping it there for twenty minutes, which is called "Pasteurisation," has the advantage that it does not give it the unpleasant taste of boiled milk. It is said to destroy all the non-sporebearing organisms and, if satisfactorily prepared, seems to be quite safe to use, provided the milk has not to be kept for any time. It has, however, the disadvantage that its preparation requires both time and intelligent care. If the heating is not prolonged for twenty minutes, or the temperature is less than 160° F., it is probably not sufficient. Another drawback to the use of pasteurised milk which has been suggested is that its preparation arrests the lactic acid fermentation, and may in this way favour the growth of any other organisms that have survived the heating.

So long as the control of the milk-supply is so utterly inefficient as it is at present in this country, it will be necessary to recommend that all fresh dairy milk should be boiled before it is used. It is also advisable always to make sure that the milk has not been already sterilised in the dairy, as repeated heating destroys the vitamines in the milk and tends to produce

scurvy and possibly other forms of ill-health. As has been already mentioned (p. 120), the curd of cows' milk is rendered more digestible by boiling so that casein curds do not appear in the stools as they do when the milk is given raw.

Peptonised Milk.—*See* Appendix J, p. 841.

The Feeding Bottle.

The bottle used in feeding the infant should be as simple in form as possible—a plain flask with no angles in it. It should be capable of holding from 8 to 10 oz., and it is sometimes an advantage to have it graduated in half-ounces. It should have no cork or tube connected with it, and should be provided with a plain conical rubber nipple which will fit over its neck, and is wide enough to be easily turned inside out and scrubbed with a nail-brush. The opening in the nipple should vary in size according to the strength of the child. Generally speaking, it should be large enough to allow the milk to drop through it rapidly when the bottle is turned upside down, but not so large as to let it run from it in a stream. A good form of bottle is that which has an opening at both ends, so that a stream of water can be run through it for cleansing purposes.

The variety of bottle in which the nipple is situated at the end of a long rubber tube, with a glass tube hanging inside, is altogether objectionable. It is practically impossible to keep such bottles perfectly clean, and they encourage ways of feeding the baby which are bad for him, however they may seem to save the mother trouble.

It is well to provide at least two bottles and two nipples so that they can be used alternately. Far the best plan, however, is to have a separate bottle for each feed. When this is done, all the milk for the day can be modified and sterilised at the same time, and the bottles filled, stoppered with cotton wool and set in a cool place. They are then safe from contamination and ready for use when required.

The Use of the Bottle.

When the mother or nurse gives the bottle, she should sit down, take the baby on her knee, and pay as much attention to the process as she would to that of suckling. The food

should be given at about the temperature of the body, and the child should be allowed fifteen or twenty minutes at most for his meal. Regularity in the times of the meals is even more important than in the case of breast-feeding, and the intervals should be the same.

When the meal is over, the bottle and nipple must at once be thoroughly cleansed with soap and hot water. It is advisable, and in hot weather necessary, that all the bottles for the day should be sterilised by boiling. This is best done at the time the day's food is being prepared. No milk which has been for any length of time in the bottle should be given to an infant; and if any drops have dried on the glass inside they must be carefully removed with soda. The rubber teats should be frequently renewed, as they are apt to develop cracks, and then it is impossible to keep them clean.

The importance of keeping the feeding-bottle free from sourness cannot be overestimated. A single bottle of contaminated milk may start a serious, or even a fatal attack of diarrhœa. The habit, which some nurses have, of putting the rubber teat to their own lips to test the temperature of the food before giving it to the baby is *exceedingly dangerous* and should never be permitted.

The child should never be allowed to suck the nipple of an empty bottle; and the constant sucking of an imperforate rubber "comforter," which incompetent nurses favour as a means of keeping him quiet, should be forbidden as a bad habit. It must, however, be admitted that, in exceptional cases, the temporary use of a contrivance of this kind may be of real value in soothing an irritable child whose condition makes it imperative that he should be kept from crying. If it is ever allowed, the teat must be frequently sterilised by boiling and never let fall on the floor while being used.

Quantity of Food.

The amount of the milk-mixture given must vary to some extent according to the size and vigour of the individual child, as well as according to his age. The following table gives what may be regarded as suitable amounts *of breast-milk or its equivalent*, to be taken at each feeding and during the twenty-four hours respectively, by an average infant at different ages.

Schedule for Healthy Infants during the First Year
(L. Emmett Holt).

Age.	Intervals between Meals by day.	Night Feedings, 10 P.M. to 7 A.M.	No. of Feedings in 24 hours.	Quantity of each Feed.	Quantity in 24 hours.
	Hours.			Ounces.	Ounces.
1st week . . .	2	2	10	1 to 1½	10 to 15
2nd to 4th week . .	2½	1	8	1½ „ 3½	12 „ 28
5th week to 2nd month	3	1	7	3 „ 5	21 „ 35
2nd to 5th month .	3	1	7	4 „ 6	28 „ 42
5th „ 9th month .	3	0	6	5 „ 7½	30 „ 45
9th „ 12th month .	4	0	5	7 „ 9	35 „ 45

In ordinary practice it has been the custom to leave the amount of the baby's food a good deal to his appetite; and, provided he is quite healthy, this may lead to satisfactory results. It is necessary, however, that the medical man should have a definite idea of the quantity of food that is required to maintain a child's nutrition satisfactorily at different ages, for we find many infants who are not thriving because they are habitually having too little food, and more who are being made ill by having too much.

Formerly we did our best to obtain a working estimate of this by comparing the amounts of milk, cream, and sugar the baby was taking, with the corresponding quantities of each of these that he should have been getting at the same age had he been on the breast—always allowing for the differences in composition and other characters of the various constituents of human, compared with those of cows' milk. At the present time, the estimation of the calories in the diet provides us with a far better and more satisfactory means of ascertaining whether the food given is adequate to the infant's needs—that is to say, whether it is capable of furnishing him with the wherewithal to keep up his nutrition and heat supply, and to provide the energy required for nervous, glandular, and muscular activity.

The Estimation of Calories.

The simplicity of a baby's diet makes its calories relatively easy to estimate, and the figures we have to bear in mind for the purpose are not very many.

An ounce of cow's milk (4 per cent. fat) represents 20, one of skim-milk 10 calories; an ounce of sugar of any kind provides 120, and one of flour 100.

The number of calories required for each pound of body-weight differs according to various conditions. The following data regarding the number of calories necessary for different weights are given by Dennett.[1]

	Calories per lb.
Fat infants over four months of age need . . .	40 to 45
Average under four months and moderately thin infants of any age	50 „ 55
Emaciated infants (varying with the degree of emaciation)	60 „ 65

The very fat infant needs less nourishment because his body surface is relatively smaller and he therefore loses less heat.

In framing the diet for a baby in accordance with his caloric requirements, we begin (1) by putting down the total number of calories that are needed, theoretically, for his nourishment.

(2) We next arrange for the necessary minimum of protein required for growth and for repair of tissue-waste. This is done by taking one-tenth of the body-weight of milk.

(3) Then we note how many calories are provided by the protein, fat, and sugar which this amount of milk contains, and how far they fall short of the full number needed.

(4) Lastly, we supply the extra calories by adding either sugar only, or sugar and milk, or sugar and cream, according as these are indicated by the child's general condition and digestion.

Example.—(1) A child of four months who weighs 12 lbs. requires $12 \times 45 = 540$ calories in his daily food.

(2) To supply the necessary amount of protein we begin by allowing him one-tenth of his body-weight (192 oz.) of cows' milk, *i.e.*, 19 oz.

(3) From this we gain $19 \times 20 = 380$ calories, that is to say, 160 calories short of the required number.

(4) To make up the calories to the proper amount, we may add to the day's supply 2 oz. of milk (40 calories) and 1 oz. of sugar (120 calories).

[1] Dennett, *Simplified Infant Feeding* (Lippincott), Phila. and Lond., 1915, 58.

At this age the child takes seven feeds of 5 oz. each in the twenty-four hours. Water may therefore be added to raise the quantity to 35 oz.

An estimation of the caloric value of the infant's diet is a most useful means of finding out whether it is sufficiently nourishing. Its everyday use in infant feeding, however, is generally held to be superfluous, and if too much is expected from it, and enough thought is not given to other considerations, it may even be misleading. There are many circumstances under which the usual data are not applicable. For example, they are not so in the cases of infants who have been recently overfed or underfed; in those who have, or have recently had, diarrhœa or vomiting; in those whose appetite is very bad, and under various other not uncommon conditions.

Addition of Citrate of Soda.—Citration of the milk used in infant feeding was first suggested by A. E. Wright,[1] and its practical results were described later by Poynton.[2] The method has now been widely and successfully used. Its effect in making the milk more digestible is explained as follows. The curdling of cows' milk which is caused by acid in the stomach, produces a loose and easily digested clot; while that caused by the action of rennet is hard and compact. This character of the rennet curd has been shown to depend on the large amount of lime-salts present in cows' milk. When citrate of soda is added to the milk a considerable proportion of the lime-salts is precipitated, and the formation of curd by the rennet is thereby delayed and rendered less complete, or even prevented, so that the milk is more easily digested.

Bosworth and Van Slyke have shown[3] that plain cows' milk is curdled by a solution of rennet in six minutes; but that, if 1 gr. of sodium citrate is added to each ounce of the milk, it takes thirty-seven minutes to curdle; and, if 1·7 grs. or more to the ounce are used, no curdling at all takes place. This is due to precipitation of the lime-salts by the sodium citrate.

A solution of citrate of soda is ordered which contains in each drachm the number of grains required for a feed (usually 2 grs. to every ounce of cows' milk in it), and the mother is told to put a teaspoonful of the solution into every bottle just before

[1] *Lancet*, 22nd July 1893, 194.
[2] *Ibid.*, 13th August 1904, 433.
[3] *Amer. Journ. Dis. Child.*, 1914, vii., 298.

it is given to the child. It is well to add a minim of chloroform to each 4 oz. of the solution to prevent any chance of a fungus growing in it.

The addition of citrate of soda has often proved very useful in my experience. It enables many babies to digest a larger proportion of casein than they could without it. The increased amount of casein which the citration enables the baby to take may, however, give rise to a degree of constipation.

Buttermilk.—Ordinary buttermilk is the fluid which remains after the butter has been removed from soured cream by churning, though ordinary milk may be used in its preparation. It has the advantage that its protein is more easily digested than that of ordinary cows' milk and is not coagulated by rennet, also that the casein is finely divided and the proportion of the fat very low; it is a cheap food, but has the disadvantage that it contains many impurities. It supplies about 10 calories to the ounce (Appendix J). Its composition is given as follows:—

Composition of Buttermilk (Vieth).

Fat	0·50	Protein	3·60
Milk Sugar	4·60	Inorganic Salts	0·75
Lactic Acid	0·80	Water	90·25

It is customary to add barley or wheat flour to it in the proportion of two level tablespoonfuls to the pint, to sterilise it by slow heating for twenty minutes, and, further, to add two level teaspoonfuls of cane or milk sugar. These additions, of course, greatly increase its nutrient value. When buttermilk is heated, the fine division of the casein is destroyed, unless it is constantly and violently stirred during the process. As heating kills the lactic acid bacilli, this should not be done if they are wanted to act on the other organisms in the bowel. While it is not suitable for the ordinary feeding of healthy infants, buttermilk is sometimes very useful in cases of casein indigestion and intestinal toxæmia.

In some countries much use is made in infant feeding of buttermilk prepared by fermenting sweet milk by the addition of some variety of lactic acid-forming organism—usually bacillus Bulgaricus. Such buttermilk has the protein and fat composition of the milk from which it is made. It is called "lactic acid milk" in America, and it differs from ordinary buttermilk, both

in its composition and in its much greater cleanliness; its preparation is also simpler. It is often found useful in the treatment of diarrhœas of the fermentative type.

Whey.—Whey was formerly much used in the feeding of delicate infants, and certainly it is of value in some cases when properly prepared (Appendix J). Its composition is given as follows:—lactalbumin, 0·75 per cent.; fat, 0·2 per cent.; and milk sugar, 4 per cent (Still). If the curd is very thoroughly broken up before straining, the percentage of fat may be raised to 0·8.

It used to be held that the whey was the most easily digestible part of the cow's milk, but L. F. Meyer seems to have shown that this was a mistake. He found that infants who were unable to digest cows' milk had no difficulty when its casein was separated and given in the whey of human milk, while a mixture containing the curd of human milk in the whey of cows' milk was not usually well digested.

Finkelstein and his school believe that the casein curds found in diarrhœa stools are only a symptom and not the cause of the diarrhœa; and that the chief source of disturbance of the action of the intestinal epithelium is due to the carbohydrates and the salts in the whey. The fermentative processes, normal and abnormal, which take place in the bowel when cows' milk is given, are due to the presence of carbohydrates and to the concentration of the whey. The relative proportion of the casein to the carbohydrates in it may also have an important effect on these processes. The addition of extra sugar should therefore always be accompanied by increased dilution of the mixture. The effect of increasing the proportion of casein is to inhibit fermentation. Finkelstein's "albumin-milk" (Appendix J) is an attempt to produce such a mixture, with a high percentage of casein and a dilute whey. In spite of Finkelstein's theory, it is a matter of experience that many small babies suffering from indigestion do very well for a time on whey. From recent work (Mendel and Osborne[1]) it seems that whey contains something which is essential for proper growth and health, and no one has as yet succeeded in making a thoroughly satisfactory substitute for milk that does not contain it.

Asses' Milk.—The chief characteristics of asses' milk are its low percentage of fat and of protein, and the fact that a con-

[1] "Protein-free Milk," *Carnegie Institute of Washington, Public.*, 156, 1911, Pt. ii., 80.

siderable proportion of the protein is in the form of lactalbumin, so that the curd which it forms resembles that of human milk in its physical qualities. Its composition varies considerably; it may be given approximately as follows:—

Average Composition of Asses' Milk (Still).

Fat	1·0	Lactalbumin	0·8
Milk Sugar	5·5	Salts	0·4
Casein	1·0	Water	91·3

While its low nutritive qualities make it an unsatisfactory food to give for any length of time to an older infant, it is extremely useful for the temporary treatment of young babies who have an idiosyncrasy which prevents their being able to digest cows' milk in any form, and in various forms of indigestion. It is, for example, invaluable in many cases of cœliac disease. It should be given undiluted and unboiled, and it may be safely used raw, as the ass is practically immune to tuberculosis. Unless a low percentage of fat is desired, the cream may be supplemented by cod-liver oil emulsion or, in some cases, by ordinary cream. If it proves too laxative, citrate of soda or liq. calc. sacch. (10 minims to 1 oz.) may be added. When obtained from a dairy it is extremely expensive, but donkeys do not cost much and they are easily kept.

Goats' Milk.—Goats' milk is not very different in composition from that of the cow. It is as follows:—

Average Composition of Goats' Milk (König).

Fat	4.07	Salts	0·85
Milk Sugar	4·63	Water	86·88
Protein (mostly casein)	3·76		

Goats' milk is now being used more than formerly because goats are very rarely affected by tuberculosis. The fat droplets in it are said to be smaller than those in cows' milk, but the casein coagulates quickly and forms compact curds. When it is largely used in hot climates, as in some parts of India and on the Mediterranean, it has the disadvantage that it may communicate the infection of undulant (Malta) fever.

Condensed Milk.

Condensed milk is prepared by sterilising fresh cows' milk by heat (212° F.) and evaporating it *in vacuo*. In some instances it is simply condensed (unsweetened condensed milk); in others

(sweetened condensed milk), about 7 oz. of cane sugar are added to each pint of milk. When we compare the analyses of specimens of condensed milk that are given by various authorities, we get the impression that the composition of the different brands varies a great deal; and that of different specimens of the same brand is not always the same.

Sweetened Condensed Milk.—Even when one of the better brands of sweetened condensed milk—such as Nestlé's—is used, in the proportion of a heaped teaspoonful to 3 oz. of water, the mixture only contains about 1 per cent. of protein, 1 per cent. of fat, and from 6 to 7 per cent. of sugar (mostly cane sugar). It is therefore not sufficiently nourishing for prolonged use in infant feeding, and the amount of cane sugar it contains is apt to produce looseness of the bowels. When given in a much weaker solution, as it very generally is among the poor, it is extremely deficient in nutritive properties. The small proportion of cream in this food results in a deficiency of the accessory food factors, and it is therefore a fruitful source of rickets and of infantile scurvy.

Unsweetened Condensed Milk.—Those brands of condensed milk to which no cane sugar has been added are free from some of the disadvantages of the sweetened varieties; but they are expensive and ordinarily have no advantages over properly prepared cows' milk. They are usually not more than twice the strength of fresh milk; and once the tin is opened they do not keep longer than ordinary milk does, so that they cannot safely be used after more than from twenty-four to thirty-six hours even in cool weather Some specimens are sterile, but others are not so. Sugar should be added to the mixture in the same way as to ordinary cows' milk.

Uses of Condensed Milk.—Condensed milk may sometimes be very useful during journeys, and when the ordinary milk supply is temporarily interfered with; but, for the ordinary purpose of feeding infants, it is not to be regarded as at all equivalent to properly prepared fresh cows' milk. The small proportions of protein and fat which it contains make it useful as a temporary food in some forms of indigestion with vomiting, but the sweetened varieties are apt to cause fermentation and diarrhœa owing to their large proportion of cane sugar. In any case it should only be used for a short time

It is not uncommon to find that infants, who have been suffering from vomiting and loss of weight, cease vomiting and gain weight at once on being put on condensed milk. In these cases the cessation of the vomiting can be explained by the low percentage of protein and fat in the condensed milk, while the gain in weight is deceptive for it depends on a retention of water in the body caused by the high percentage of cane sugar given (p. 113). Children fed habitually on condensed milk are often fat, but they are also flabby and have a low resistance to disease. Should they suffer from intestinal toxæmia they are apt to undergo a dangerously rapid loss of weight and strength.

Dried Milk.

Dried milk consists of cows' milk which has been reduced to a fine powder by evaporation either at a moderate or high temperature. It has recently come largely into use, and is sometimes valuable in infant feeding when preparations of fresh milk cannot be obtained or have failed to agree, and when neither human or asses' milk can be obtained. The varieties most used in this country are "Glaxo," "Cow and Gate Milk," and "Trumilk." They are apparently sterile and keep indefinitely in the tins. When diluted, in the proportion of one ounce of water to the teaspoonful of milk-powder, they are said to have an approximate composition of protein 2·1, fat 2·5, and milk sugar 4·29 per cent. (Still); but some specimens have a much higher proportion of fat. Those forms of dried milk which are prepared by exposure to a high temperature for a short time contain enough of the accessory food factors A and B, but the fact that they occasionally cause scurvy shows that the factor C is apt to be diminished or destroyed; and it is always advisable to give orange juice along with them. They often agree well with healthy children; and Porchat in Lyons and Eric Pritchard in London have reported good results from their use in dispensary practice. In many infants, however, they set up fat indigestion with hard white soapy stools. This is due probably, not only to their containing too high a proportion of fat, but also to the process of manufacture having interfered with its emulsification, so that it is present in the form of butter rather than in that of cream, which makes it less easy to digest.

Varieties of "Cow and Gate Milk" and "Glaxo" can now be obtained from which half the cream has been removed. These forms are more generally useful than the kinds with full cream; for we must remember that in feeding infants with dried (as with fresh) cows' milk, more protein and less cream should be allowed than are found in breast-milk, owing to the different characters of these substances in the two forms of milk.

Dried milk is rather an expensive form of food for infants.

Proprietary Infant Foods.

There is a large variety of "infant foods" on the market; and, although they are not in themselves of much value in the feeding of babies, they are so largely made use of by the public that it is essential that the medical practitioner should know something about the composition of the most popular of them. The manufacturers generally claim that they are "perfect substitutes for mothers' milk." One has only to glance at their analyses—even those published by the makers themselves—to see that this claim is not justified, and that their composition and characters are very different from those of human milk.

The proprietary infant foods have the further disadvantages that, as they yield large profits to their makers and are much advertised, they are very expensive; and also that, as in the case of patent medicines, they are accompanied by statements which are sometimes quite erroneous, and always calculated to mislead the ignorant mothers who buy them, by giving them an exaggerated estimate of their usefulness and universal applicability to all babies.

The great majority of proprietary infant foods must, from their composition, be seriously deficient in all the accessory food factors, which goes far to explain the flabbiness and subnormal resistance to disease which infants fed on them frequently show.

The accompanying table, which has been prepared for me by Dr E. Bronson, shows the composition of the "infant foods" which are most largely used in this country. It includes also that of some of the dried milks, as they are sometimes advertised as "infant foods."

TABLE OF THE COMPOSITION OF INFANT FOODS.

GROUP I.—MILK FOODS.

Sub-Group A.—Dried Milks.

The fat in dried milks is usually in an unemulsified form. Water only to be added.

	Water.	Salts.	Fat.	Protein.	Carbohydrate	When diluted, 1 drm.[1] to 1 oz. by weight.			Remarks.
						Fat.	Protein.	Carbohydrate.	
Cow and Gate—									
(Full cream)[3] . .	4·56	6·60	26·86	26·15	35·83	....	...	...	
(Half cream) . .	7·47	7·33	16·05	35·59	33·56	...	...	...	
Glaxo[2]	4·8	5·2	25·4	21·7	42·9	3·2	2·8	5·35	A small amount of lactose has been added to a full-cream milk.
Dryco or Honour Brand[3]	3·0	7·0	12·0	34·0	44·0	1·5	4·0	5·5	An easily digested dried milk, but unsatisfactory for continued feeding because of the low fat content. One level tablespoon = 16 calories.
Trumilk[4] . . .	3·8	6·0	27·4	25·6	37·2	3·4	3·2	4·65	A good quality of dried whole milk.

Sub-Group B.—Sweetened Condensed Milks.

The low protein and lactose in these foods indicate the small amount of milk solids in their composition. As the analyses indicate they are inadequate as foods. One part is added to five parts of water.

Borden's Eagle Brand[5] .	25·66	1·78	9·61	8·01	54·94	1·6	1·3	9·15	Of the total carbohydrates, 42·81 per cent. is cane sugar and 12·03 per cent. lactose.
Milkmaid Brand[6] . .	23·7	2·3	11·0	9·7	53·3	1·8	1·6	8·8	Of the total carbohydrates, 38·7 per cent. is cane sugar and 14·6 per cent. lactose.
Nestlé's[6] . . .	22·8	1·6	13·7	9·7	52·2	2·28	1·6	8·7	Of the total carbohydrates, 37·2 per cent. is cane sugar and 15 per cent. lactose.

Sub-Group C.—Unsweetened Condensed or Evaporated Milks.

With the water replaced, these foods are supposed to have the composition of cows' milk. One part is added to two parts of water.

Borden's Evaporat'd Milk[3]	73·27	1·43	8·1	7·15	10·05	...	...	...	Because the protein is disproportionately low, this analysis indicates that extra cream and sugar have been added so as to resemble the mother's milk more nearly.
Ideal[6]	62·0	1·3	12·4	8·3	16·0	4·1	2·7	5·3	
Hollandia[6] . . .	57·0	3·4	9·8	11·3	18·5	3·26	3·76	6·1	The analysis indicates the addition of a small amount of sugar.

GROUP II.—MILK AND MALTED FOODS.[7]

This Group consists more or less completely of malted starch combined with dried milk.

Sub-Group A.—No Insoluble Carbohydrates.

This Sub-Group has no insoluble carbohydrates. Water only to be added in the proportion of one oz. by weight to one drm. of the food.

Allenbury's No. 1[6] .	5·7	3·75	18·5	9·7	62·3	2·3	1·09	7·78	Defective in low protein, a part of which is of vegetable origin. This food is especially defective in the accessory substances which protect against scurvy.
Allenbury's No. 2[6] .	3·9	3·5	17·6	9·2	66·8	1·9	1·15	8·25	Contains some malted flour. Even more of the protein than in No. 1 is of vegetable origin.
Horlick's Malted Milk[6].	3·7	2·7	9·0	13·8	70·8	1·1	1·47	8·85	Dried milk and malted wheat flour. Defective both in fat and protein, a part of which is of vegetable origin.
Neaves' Milk Food[6] .	2·4	4·5	26·0	20·0	47·1	3·25	2·5	5·88	The analysis indicates a fairly satisfactory food, a dried milk with additional carbohydrate as maltose and lactose.

TABLE OF THE COMPOSITION OF INFANT FOODS—*continued.*

GROUP II.—MILK AND MALTED FOODS—*continued.*

SUB-GROUP B.—CONTAINING UNALTERED STARCH.

This Sub-Group, to which water only is to be added, give a very unbalanced diet, suitable only for the most temporary use when a carbohydrate food is desired.

	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When diluted, 1 drm. to 1 oz. by weight.			Remarks.
						Fat.	Protein.	Carbo-hydrate.	
Carnrick's Soluble Food[6]	5·3	2·2	2·5	13·6	76·2	0·3	1·7	9·5	Dried skimmed milk, 37·5 per cent.; partly malted wheat flour, 37·5 per cent.; and lactose, 25 per cent.
Milo Food[6] . . .	3·6	1·9	5·2	14·0	75·3	0·6	1·7	9·4	Nestlé's Food has practically the same composition. Insoluble carbohydrate 15·39 per cent.; soluble carbohydrate 58·93 per cent., of which 25 per cent. is cane sugar, 27 per cent. maltose and dextrin, the remainder lactose.

GROUP III.—FOODS MAINLY CARBOHYDRATE.[8]

SUB-GROUP A.—SOLUBLE CARBOHYDRATES ONLY.

As the analyses show, these foods offer no advantages over dextri-maltose purchased as such. Used with milk, they supply sugar in a very expensive form. The excess of salts added may be an additional disadvantage.

Cheltine Maltose Food[6]	4·6	2·25	0·27	5·3	87·6	negligible.	0·66	10·95	A malted cereal food containing no unaltered starch.
Mellin's Food[6] . .	6·3	3·8	trace	7·9	82·0	,,	0·98	10·25	Essentially a preparation of dextrin and maltose in the proportion of 1 to 3. Gluten cells are

									present. This fact, together with absence of lactose, indicates a protein of vegetable origin, *i.e.*, from the malted grain. Potassium bicarbonate added. Caloric value = 105 to the ounce by weight.
Hovis Babies' Food No. 1 [6]	3·7	1·82	0·2	7·7	86·6	...	...	...	A fully malted food. Carbohydrates entirely in the form of maltose and dextrin.

Sub-Group B.—Carbohydrates partly Insoluble (Starch).

This Sub-Group, also to be used with milk, are useful though expensive and unnecessary additions to a milk formula when one desires to start starch-feeding. Well-baked wheat flour is equally satisfactory, especially when prepared with malt.

Allenbury's Malted Food [6]	6·5	0·5	1·0	9·2	82·8	0·12	1·15	10·35	A mixture of wheat flour and malt. It contains unaltered starch when prepared for use.
Benger's Food [6]	8·3	0·8	1·2	10·2	79·5	0·15	1·27	9·8	A mixture of wheat flour and pancreatic extract. Both starch and proteins are partially digested in its preparation.
Moseley's Food [6]	10·8	0·94	0·92	11·0	76·4	0·11	1·7	9·55	When well prepared, all starch is converted.
Savory & Moore's Food [6]	4·5	0·6	1·4	10·3	83·2	0·17	1·3	10·4	A mixture of wheat flour and malt. Nearly all the starch is converted.

Sub-Group C.—Essentially Starch Foods.

These foods are advertised to be used with milk. In analysis they are similar to wheat flour, with a varying proportion of the starch changed by baking to dextrin and maltose. If the mixtures are "prepared according to directions," they contain too much starch and too little milk.

Wheat Flour [9]	...	...	1·0	11·4	75·1	0·12	1·4	8·39	
Eskay's Food [3]	3·06	1·34	1·2	6·56	87·8	0.15	0·82	10·97	Raw arrowroot starch and cooked cereal starch. Contains a small percentage of whole egg. Insoluble carbohydrates about 21·21 per cent.
Frame Food Diet [6]	5·0	1·0	1·2	13·4	79·4	0·15	1·67	9·9	Essentially a baked flour to which cane sugar has been added.
Neaves' Food [6]	6·5	1·6	1·0	10·5	80·4	0·12	1·3	10·05	Baked flour. The percentage of unconverted starch varies.

TABLE OF THE COMPOSITION OF INFANT FOODS—*continued.*

GROUP III.—FOODS MAINLY CARBOHYDRATE—*continued.*

SUB-GROUP C.—ESSENTIALLY STARCH FOODS—*continued.*

	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When diluted, 1 drm. to 1 oz. by weight.			Remarks.
						Fat.	Protein.	Carbohydrate.	
Ridge's Food[6] . .	7·9	0·7	1·0	9·2	81·2	0·12	1·15	10·15	Baked flour, in one analysis containing only about 3 per cent. of soluble carbohydrates. The various analyses differ widely in this respect.
Robinson's Patent Barley[6]	10·1	1·9	0·9	5·1	82·0	0·1	0·6	10·2	Barley need not be patented to be a useful cereal.
Sister Laura's Food[10] .	6·89	1·15	0·89	9·9	81·05	...	...	...	Seems to be composed of baked flour. It is recommended to add 1 teaspoonful to 5 oz. of undiluted milk. It is claimed that its chief value consists in its helping the digestion of the milk.
Robinson's Groats[6] .	10·4	1·7	1·6	11·3	75·0	...	...	...	Ground oats from which the husk has been removed. Rich in protein and mineral matter.
Scott's Oat Flour[6] .	5·8	1·3	5·0	9·7	78·2	...	...	...	A fine oat-flour. Somewhat inferior in nutritive value to "groats." Starch unaltered.
Hovis Babies' Food No. 2[6]	2·4	1·7	0·1	5·7	90·1	...	...	...	Contains about 7½ per cent. of starch. To be made up with milk.
Cheltine Infants' Food[6].	7·2	1·83	3·92	16·2	71·0	...	...	...	Contains starch when prepared for use.

[1] Two level teaspoonfuls weigh about 1 drm.
[2] Still, *Common Disorders of Childhood.*
[3] Manufacturer's Analysis.
[4] Mendel and Osborne, "Feeding Experiments," *Carnegie Institute Rep.*, 156.
[5] Holt, *Diseases of Infancy and Childhood.*
[6] R. Hutchison, *Food and the Principles of Dietetics.*
[7] As the dilution of 1 drm. to 1 oz. of water is used with these dried foods, comparison with dried milk may be made.
[8] Two level teaspoonfuls approximate 1 drm. by weight, hence 1 teaspoonful to the ounce of milk adds about 5 per cent. of carbohydrate.
[9] Morse and Talbot, *Diseases of Nutrition and Infant Feeding.*
[10] Analysis by Dr Drinkwater.

The different proprietary foods may be roughly divided into three groups: Milk Foods, Malted Foods, and Farinaceous Foods.

(1) **The Milk Foods**, which include some forms of dried and condensed milk, are made from cows' milk, with or without various alterations and additions. They only need the addition of water to prepare them for use. Most of them have too little cream and too much sugar. Examples of this group are Allenbury's No. 1 and No. 2 Foods, Carnrick's Soluble Food, Horlick's Malted Milk, and Milo Food. All of them have the advantage, from the point of view of digestion, that the casein they contain is in an easily digested state and clots loosely, if at all, with rennet, but their low percentage of fat renders them unfit for prolonged use.

(2) **Malted Foods** consist of cereals, the starch of which has been transformed more or less completely into soluble forms of carbohydrate. In some of these, as is seen in the table, the dextrinised cereal is combined with condensed or dried milk. To the others, milk has always to be added; for, if mixed with water only, they are altogether deficient in fat, protein, and mineral salts. They may be divided into two classes:—

(*a*) Those in which the dextrinisation of the starch has been carried out completely before the food is offered for sale. This includes Mellin's and Cheltine Foods and Hovis Babies' Food No. 1. Completely malted foods are sometimes useful in the treatment of certain food disorders in which dextrose and maltose are more easily digested than milk sugar.

(*b*) Those containing starch combined with malt and pancreatic ferment, so that it is partially converted during the process of preparation of the food, *e.g.*, Benger's Food, Moseley's Food, Savory and Moore's Food, and Allenbury's No. 3 Food.

When the malted foods are added to cows' milk they sometimes make it more easily digested, probably in the same way as barley water does; and they are therefore useful in certain cases as a temporary addition to the diet after the sixth month.

(3) **Farinaceous Foods** (Group III., Sub-Group C in the table) are composed of wheat or some other cereal, the

starch of which has not been acted on by malt or pancreatic ferment. We have already seen that starch is not, as a rule, a suitable food for babies before the beginning of dentition. These foods form quite a suitable addition to the diet of older infants, but they are much more expensive, and in no respect preferable to such ordinary foods as wheat, barley, or oat flour, or even to rice or rusks. Ordinary forms of flour can be easily malted at home, if necessary, by the use of a home-made infusion of crushed malt such as Sir Wm. Roberts recommended (Appendix J).

A study of the table will show that, when prepared according to the directions supplied with them, all these preparations are deficient in composition in various particulars. It must also be pointed out that, although the mere chemical composition of some of them seems at first sight satisfactory, they are very inferior to human milk for other reasons. Some of the ways in which they are defective may be stated as follows :—

(1) **Fat Content.**—Nearly all of them are deficient in the amount of fat they contain; and in some instances the fat, though sufficient in quantity, has had its emulsification destroyed in the process of manufacture so that it is more difficult to digest than that of fresh milk.

(2) **Protein Content.** — Many of the "foods" contain too little protein. In many also the nitrogenous constituent is in the form of vegetable albumin which is not equivalent to the protein of milk, as only about 30 per cent. of it can be utilised by the baby.

(3) **Carbohydrate Content.**—Most of them contain far too large a proportion of carbohydrate; and many are quite unsuitable for young infants because so much of it is in the form of unaltered starch.

(4) **Antiscorbutic Food Factors.** — All the "infant foods" are more or less deficient in antiscorbutic qualities. The great majority of the cases of infantile scurvy we see in this country are in infants who have been fed for many months on proprietary foods.

(5) **Antirachitic Properties.**—Most children fed largely on "infant foods" become rickety sooner or later.

Food, other than Milk, Suitable during the First Year.

When the baby is six or seven months old, his first teeth usually make their appearance; and, when several of these are through the gum, this is a natural indication that the digestion is beginning to be fit for more complicated food. The child also often at this time shows signs of being less satisfied with his exclusively milk diet, and gains weight less steadily. It is now usually advisable to begin some form of starchy food, though, if the child is growing quite satisfactorily and is contented, it may be just as well to go on with milk for another month or two, especially if the teeth are late in coming. When, however, in a healthy child the teeth are very late in appearing, this should not of itself be considered a sufficient reason for deferring indefinitely the use of farinaceous food. It must, of course, be explained to the mother that the starchy food is to be given as an addition to the milk and is not to take its place.

When the baby is nine or ten months old, he should have five meals a day. These should consist mainly of milk, still diluted a little, but to the first and fourth some suitable farinaceous food should be added. For this purpose oat flour does very well or barley or wheat flour, barley jelly or bread jelly (see Appendix J), or one of the proprietary infant foods.

It is also well about the tenth month to add some additional nitrogenous food to the midday meal, such as clear soup, beef tea or chicken tea, or to give half the yolk of a raw or lightly boiled egg beaten up with the milk. The following analyses are of interest in this connection :—

Ordinary Beef Tea (Cheadle).		White of Egg (König).		Yolk of Egg (König).	
Water	96·31	Water	85·50	Water	51·03
Fat	0·00	Fat	0·25	Fat	31·39
Protein	0·82	Protein	12·87	Protein	16·12
Extractives	2·09	Free Extractives	0·77	Free Extractives	0·48
Salts	0·78	Salts	0·61	Salts	1·10

The appearance of the teeth affords another important indication as to the infant's feeding, besides calling for the addition of starch to the diet. It points to the need of the

child having some form of food that will give the new teeth something to do and train him in the use of his jaws for other purposes than mere sucking (p. 48). It is therefore a natural and proper thing now to give him a crust or piece of baked bread to chew, or to let him gnaw occasionally a chicken or chop bone with a little meat on it.

It is also wholesome for the child, at this stage, to have a little fruit juice (orange or grape, from ½ to 1 oz. in the day); and it is a good plan to let him further exercise his teeth and jaws in getting it. This may be done by giving him a section of a ripe orange to chew, after the pips have been removed. Stewed or baked apple may also be given; and it is a good thing to dilute the baby's milk with water in which vegetables have been boiled. A mistake which is often made is to give a great excess of starchy food in place of milk. This is a fruitful source of indigestion and rickets. Another serious mistake is to add sugar to the child's milk and to his farinaceous food. The starch is meant to take the place in the diet which was filled at an earlier age by sugar; and the continued sweetening of the food is not only unnecessary but injurious. It lessens the child's natural relish for the taste of cereal and fatty foods, and creates an unnatural craving for sugar. Pap made of boiled bread and milk to which sugar has been added is a very pernicious form of food for babies. Even at this age it is well to give him a little baked bread (p. 49) with salt butter.

Food during the Second Year.

After the end of the first year, the infant's midday meal should be increased. In addition to what has been already mentioned, he may have, in moderation, such things as potato, rusk, or bread-crumbs with gravy, such easily digested vegetables as spinach, cauliflower, asparagus, or vegetable marrow, a lightly boiled egg, custard pudding, curds, well-boiled porridge, or any plain farinaceous pudding, without the addition of sugar. Baked bread or toast with salt butter, in gradually increasing amounts, should form a regular part of his diet. Oatmeal porridge is often objected to by dentists and physicians; but, though it disagrees with some children and should not therefore be given to them, it would be difficult to deny that, when well

made of good meal and well salted, it is for the majority of children a most wholesome as well as an appetising food. When made of inferior meal without salt, and eaten with sugar, as we often get it in England, it well deserves the bad things said about it. When we consider that the solid food given to a child in his second year requires certain alterations before he can digest it, we must remember also that Nature has made provision for this, and that the child is bound to suffer, if he is not allowed to make full use of the organs with which he has been supplied for this purpose. In other words, we must bear in mind that the teeth, jaws, and muscles of mastication, on the natural development of which the future health will to a large extent depend, should have a normal amount of exercise at this time of life. A diet, which gives no exercise to the jaws and discourages the free secretion of normal saliva, usually results in the jaws becoming undergrown and deformed, and consequently predisposes to crowding and decay of the permanent teeth.

In the second year, milk should still form a large part of the child's diet. It need not usually be diluted and no sugar should be added to it; for he is getting plenty of carbohydrate in the form of starch, and it is good for him now to have it in that form. By the fifteenth month, at latest, the bottle should be discontinued and all the milk given from a cup. Thirty oz. of milk in the day are sufficient for a healthy child at this age.

After eighteen months, four meals a day should be given and it will be better for the child not to be wakened for a late meal, but allowed to sleep right on to the morning. A little fish, chicken, rabbit, or butcher meat, fat bacon, or a lightly boiled egg may be given for dinner. The meat should not be minced too finely, as it is most important that the child should be encouraged to acquire the habit of chewing his food. The amount of potato and pudding is also to be increased, and stewed fruit and vegetables given, as well as baked bread with butter.

Alcohol, tea, and coffee should, of course, form no part of a young child's diet; and pastry, cheese, and sweets are also unsuitable at this age. Little or no water should be given with the food; but it is good for the child to be allowed a drink of water between his meals. Small extra meals,

consisting of milk and biscuits, or bread and butter, given on waking, between breakfast and dinner, or the last thing at night, are altogether inadvisable for healthy children.

Diet in Older Children.

Children who have been judiciously fed and wisely trained from early infancy are not likely to give trouble in the matter of diet as they grow older. Their healthy appetites, normal tastes, and sound digestions may be trusted to be fairly safe guides as to what they ought, and what they ought not, to have Unfortunately, however, a majority of the children whose feeding we are asked to supervise have already acquired bad habits of eating and abnormal tastes. These by long practice have become a second nature to them, so that it is necessary to explain to their parents the main dietetic rules which should guide them, and even to write out a list of the articles of which the child's meals should consist.

A few general principles may be recapitulated as follows :—

1. **Composition of the Meals.**—Although an increase of starchy food is natural and beneficial at this stage, we must guard against the common mistake of giving such food in excess. In many cases loss of appetite, debility, and chronic intestinal indigestion are due to errors of this kind.

It is important that the growing child should have plenty of animal protein ; but this also must not be given in too large an amount. Many children have a craving for meat. In some hospitals, owing to this, a practice has arisen of giving the pudding course of the dinner before the meat, because it is found that, when the meat is given first, the children cry for more and refuse the pudding. This, in the case of poor children, may perhaps be regarded as an indication that they need more animal food than they have been getting.

Sufficient fatty food is also important, and the bad habit of leaving the fat of the meat must be checked from the beginning, and butter also freely allowed. A taste for vegetables should always be encouraged, but an excess of potatoes is to be avoided. Fruit is very useful for healthy children, although it often disagrees with those whose intestinal digestion has been weakened by too much starchy food. Bananas if unripe are indigestible, but if ripe and especially if cooked they usually

agree quite well if the digestion is normal. Ripe apples are the most wholesome form of fruit for children. With a few exceptions, all fruit is best given cooked to delicate children. Sweets in moderation and at proper times are natural and wholesome, but the great danger to the teeth from their injudicious use is never to be forgotten.

The child's taste for those things which are good for him needs to be cultivated.

2. **Form of the Meals.**—The child must be taught to eat slowly and to chew his food well. With this in view, the natural taste of the food should not be interfered with; and a considerable proportion of his starchy food should be given in a hard, dry form and not, as is often done, in a pulpy, relatively tasteless or over-sweetened mass which discourages chewing.

Not only should the meals contain the food in proper forms, but they must also be arranged physiologically, and especially it is an advantage if they do not end with sticky carbohydrates which lodge about the teeth, or with sweets. The ideal thing is that such things as "milk puddings," bread and jam, cakes, biscuits, and oatcakes should be followed by fresh fruit, such as a ripe apple thoroughly chewed, to scour the teeth and incite the secretion of active saliva. Some hard form of carbohydrate such as rusk or baked bread with salt butter is also useful in this way; and it is always advisable that, at the end of the meal, the mouth should be rinsed out with plain water, or with a suitable mouth-wash (p. 52). The essential point for the preservation of the teeth is that the mouth should be left clean after eating.

The child should not take much water along with his food; but in warm weather and after exertion it is good for him to drink freely between meals.

Such a diet as the following may be regarded as suitable for a healthy child:—

Breakfast—at 8 or 8.30 A.M. Porridge and milk, a lightly boiled egg, fish or bacon, baked bread or well-done toast with salt butter, and milk; finishing with a ripe apple.

Dinner—at 1 or 1.30 P.M. First course—four days a week. Meat, fish, or poultry, green vegetables, potatoes; on the other days, meat broth or pea soup, vegetables, and potatoes. Second course—A farinaceous or custard pudding or curds,

with stewed fruit, finishing with a crust or piece of dry toast and a drink of water.

Tea—at 4.30 or 5 P.M. Rusks, toast or baked bread with butter or jelly, or plain cake, milk alone, or merely flavoured with cocoa or tea, a raw apple.

Supper—if still hungry—before or after going to bed a drink of warm milk without any starchy food and no sweets.

The following is an example of a kind of diet often given, which is calculated to leave the mouth in such a state as to encourage to the utmost the growth of acid-forming bacteria about the teeth :—

On Waking—Milk and a biscuit.

Breakfast—Porridge and milk, or boiled bread and milk, soft bread and jam.

Lunch—A few hours later, milk and a sweet biscuit.

Dinner—Mashed potatoes and gravy, minced meat, farinaceous pudding and milk.

Tea—Boiled bread and milk, or bread and jam, cake, and cocoa.

Supper—On going to bed—a glass of milk and a biscuit, and a small piece of chocolate or other sweet.

When the diet of the children in an institution has to be arranged, it is necessary to go much more fully into the details of the composition of the meals than in ordinary family practice. The caloric value of the food given, the relation of its protein and non-protein elements, that between its carbohydrates and fats, the amounts and characters of its mineral salts, and the quantity of liquids taken have all to be considered. It must also be seen to that the diet contains sufficient vitamines, lecithin, and extractives; and the variety of the meals, their taste, cooking, digestibility, absorbability and other physical properties have all to be taken carefully into account, as well as their cost.[1]

[1] Much interesting and practical information on these matters will be found in a small book on *Food Values*, by Margaret M'Killop, M.A., London (Routledge), 1916; and in *The Physiological Feeding of Children*, by Dr Eric Pritchard, London (Kimpton), 1919.

CHAPTER IX

ON THE FOOD DISORDERS OF INFANCY AND OTHER FORMS OF DIGESTIVE DISTURBANCE[1]

On Food Disorders.

A VERY common and most important group of the diseases met with in infancy, especially in hospital and dispensary practice, is that of the so-called "Food Disorders." This name is applied to them because it has long been evident that, in the majority of cases, these illnesses are due to something wrong with the feeding, although the nature of the fault is only now beginning to be understood. The causation of these maladies and their relation to one another have always been specially difficult to investigate; and our knowledge of them, till the last few years, has grown but slowly.

In former times it was the custom to name them according to their most prominent symptom—infantile atrophy or marasmus, acute vomiting, chronic diarrhœa, cholera infantum, and so on. Later, an attempt was made to form a classification according to the post-mortem appearances, and it became the habit to call the cases by the names of the pathological conditions which were, or were believed to be, present, such as gastro-enteritis and follicular enteritis. This line, however, failed to yield the satisfactory results that were expected, as

[1] The author has to acknowledge the help he has received in this chapter from the following works :—Czerny u. Keller, *Des Kindes Ernährung, Ernährungsstörungen u. Ernährungstherapie*, 6te Abth. 2te Hälfte, Leipzig u. Wien, 1906. Finkelstein, *Jahrb. f. Kinderheilk.*, 1907, lxv., 1, and 263; and 1908, lxviii., 521; and *idem, Lehrb. d. Säuglingskrankheiten*, Berlin, 1912, teil iii., 176 *et seq.* L. E. Holt, *Diseases of Infancy and Childhood*, 6th Edit., 1911. Morse and Talbot, *Diseases of Nutrition and Infant Feeding*, 1915; and Hill and Gerstley, *Clinical Lectures on Infant Feeding*, 1917. In the last-mentioned work the reader will find an admirably clear and readable account of Finkelstein's teaching.

these conditions were often very difficult to diagnose and to distinguish with any degree of certainty from one another; and especially because many of the worst cases presented no characteristic appearances at all after death. It was also evident that, when structural changes were found in the alimentary tract, they were merely the secondary results of previous functional derangements. More recently, as followed not unnaturally from the excellent work of Escherich and others on the bacteriology of the digestive organs, a classification was attempted which was founded on the types of micro-organisms in the motions. This, however, was no more successful than the pathological classification, for none of the bacteria investigated was proved to be the specific cause of the commoner forms of digestive disorder.

A great deal of valuable light has now been thrown on this group of diseases by the work of Czerny and Keller, and that of Finkelstein. To these most able observers and their pupils, and to various American workers, we owe a remarkable advance in our knowledge of this subject, and it is to methods of pathological chemistry, combined with close clinical investigation, such as they use, more than to pathological anatomy or bacteriology, that we must look in the future for further progress in this matter.

Czerny entirely changed our conception of the food disorders by showing that, while they may in some cases be attributable to bacteriological infection, either of the milk before it is given or of the baby himself, and while, owing to constitutional or other weakness, one infant may suffer from taking food that agrees perfectly well with another, the main cause in the large majority of cases is a diet in which various of the ordinary constituents are present in wrong proportions, although the quality of the milk used in preparing it may be quite satisfactory. When the child's food fails to provide him with all the material he needs to keep him in health, not only are his functions upset, but he is actually poisoned by the excess of some of the food-stuffs it contains. Strong children are often able to resist this process of poisoning, provided the degree of the excess is not very great; but when, as so frequently happens, the energy of the infant's metabolism has been lowered, either by congenital debility or by that which arises from careless feeding, severe toxæmia is sure to follow. From his

large clinical experience Czerny was able to demonstrate also that certain easily recognised symptoms were due to the child getting too much fat; and another group to a too exclusive diet of starch. He brought forward, also, the new and surprising fact that the authorities in the past were quite wrong in holding, as they had always done, that the protein constituent in the milk was the most difficult to digest; and he proved that, far from this being the case, it was the element in the food which was least likely to upset the digestion. He likewise did good service by emphasising strongly that these food disorders are not to be regarded as mere local disturbances of the stomach and bowels, but are really general diseases in the widest sense, as they implicate every organ and function in the child's body.

Finkelstein also realised the widespread influence of the food disorders on the infant; as he says, "It is the sick baby we have to study, not the diseased bowel," and he pointed out that what was wanted in this inquiry was not so much elaborate metabolism experiments and other exact physiological methods, as a more searching and accurate clinical study of individual cases. He set himself therefore to gain further light by the closest possible study, not only of the manifestations of disease in the alimentary tract, but also of the symptoms which arise in these cases in connection with the other organs and functions. He found that the pulse was sometimes slow, weak, and irregular and sometimes quickened; that the respiration in one case was feeble and slow, and in another deep and rapid; the urine at times normal, at others containing sugar, acetone, albumin, and casts; the skin soft and normal, or sallow and inelastic; the muscles flabby, or rigid, or quite unaffected; that the consciousness might be unimpaired, or that there might be marked drowsiness and delirium; also that the temperature varied from subnormal to a state of fever. The number and variety of these symptoms show how profoundly the nutrition of all the organs in the body is affected by the food disorders, for in these, as indeed in most diseases, *each organ shows the state of its nutrition by the way it does its work.*

He specially studied the daily weight-chart, and demonstrated the difference between the bottle-fed infant's curve and that of the breast baby. In the breast-fed infant the curve shows a steady continuous rise from day to day, while that of the bottle-fed baby has a more or less zigzag course. These

variations in the weight are probably to be explained by the irregular excretion and retention of the salts of the cows' milk, which cause constant changes in the amount of the fluid in the body. He also established the fact that there are four distinct types of cases which show different weight-curves that are characteristic of them. These he describes under special names. In the first of them, the gradually rising curve gives place to a straight line; this is characteristic of the condition he calls "Disturbance of Equilibrium" (Bilanzstörung). In the second, the curve turns slowly downwards showing a steady loss; this occurs in cases of "Dyspepsia." In the third type—"Decomposition"—there is a slow continuous fall, lasting over weeks or months; and in the fourth, which he calls "Intoxication," a rapid loss of weight takes place. He then proceeded, by simply studying and noting the clinical pictures which he observed in his wards, and seeking for their causes after he had described them, to differentiate further these various types from one another. Their main characteristics may be given as follows:—

1. **Disturbance of Equilibrium.**—The infants in this group are simply not gaining weight and vigour normally. Their motions are usually constipated and soapy. They are more liable than healthy babies to infections; but their general health is little interfered with.

2. **Dyspepsia.**—In this type the children are peevish and irritable, and have slight diarrhœa; but, like those in the first group, they are not very ill.

3. **Decomposition.**—This group includes cases in which nothing has agreed with the child for weeks; and he shows the typical symptoms formerly described under such names as "infantile atrophy," "wasting," and "marasmus."

4. **Intoxication.**—The infants in this condition are suffering severely from general symptoms. They have bad diarrhœa and severe and rapid loss of weight. They show marked disturbance of consciousness and more or less rise of temperature. This group, in its worst form, corresponds with the type usually known as "cholera infantum."

While it is probable, of course, that Finkelstein's observations are not to be regarded as the final word on this exceedingly difficult subject, they are so interesting and suggestive, and represent such a great advance on the views which were

formerly held on these food disorders, that it has been thought best to make much use of them in this chapter. They certainly seem to explain satisfactorily many of the facts of common experience which have hitherto remained obscure.

The symptoms of these four types of disturbance of nutrition represent the chief varieties of reaction of the child's system to the food given; and their severity depends, on the one hand, on the degree of unsuitability of the food and, on the other, on the extent of the functional debility of the patient. All the symptoms can be influenced for good or evil by changing the diet.

A few of the terms which Finkelstein uses in describing these disorders may be defined. When the taking of food is followed by normal digestion and nutrition he speaks of this as the "*Normal Reaction*"; and when, owing to the presence of nutritional disorders, abnormal symptoms set in, there is a "*Paradoxical Reaction.*" The food which in a perfectly healthy child does nothing but good, or at any rate no harm, very often sets up serious illness in a weakly infant, and its use may even end in death. He uses the term "*State of Nutrition*" to signify the structural condition of the organs and tissues — including that of the individual cells — and especially the amount of the substances in them which are necessary for their vital processes. The term "*Function of Nutrition*" denotes the energy used in carrying on the various natural processes; and, when the body is still able to make use of a maximal amount of food so as to allow of a "normal reaction," this is described as a state of "*Tolerance.*"

Signs of Health. — For health it is necessary that the structure of the body and the function of nutrition should both be normal, as otherwise the tolerance cannot be so. The satisfactory or unsatisfactory condition of the various organs and tissues is recognised, as has been already said, from the way they perform their functions. One of the most important attributes of normal structure and function is a high degree of *immunity to infection.* Owing to this, a thoroughly healthy child rarely takes infections, and, when he does, they are generally slight in character and easily recovered from. A steady temperature is an important indication that the metabolism is proceeding normally. The weight-curve should also show a steady rise. Perhaps the

most important of all the signs of health is a complete qualitative tolerance. If the body can build up its structure physiologically out of a widely varying mixture of food-stuffs, and maintain its powers of action and resistance, in spite of the combination of the food-stuffs being very different from the usual, this is of immense importance. It enables the child to develop normally in spite of the careless nursing and other unfavourable conditions that are often found among the poor. This explains the common experience that diseases of this type give us comparatively little trouble in better class practice, while they lead so often to serious illness among our dispensary and hospital cases.

To have a normal reaction under ordinary conditions there must be a certain width of tolerance, so that increase of the food does not at once upset the health. If disturbance of nutrition occurs, it upsets the collaboration of the different parts of the mechanism, and then all sorts of other symptoms arise.

Signs of Disturbance of Nutrition due to the Line of Tolerance having been Passed. — When the child has too much of one of the elements of the food, characteristic changes are produced in various parts of the body. There is pallor, and shrivelling of the subcutaneous tissues, with lowered and altered energy of every kind. A distinct lowering of the immunity occurs also, so that infections in the alimentary tract and elsewhere take place and run a severe course, the weight falls, and its curve is changed; the temperature also loses its steady character and becomes irregular; vomiting sets in, and the motions become abnormal. When this disturbance is profound, symptoms arise also in connection with the respiration, the heart's action, and the composition of the urine, showing that the nutrition of vital organs is being interfered with. This paradoxical reaction assumes different forms according to the composition of the food taken, and different errors of diet set up different clinical pictures. One kind, for example, produces fever and toxæmic symptoms; another loss of weight and subnormal temperature; and, in the same patient, excess of sugar produces one set of symptoms, and an excess of fat quite another. We may therefore say that *in most food disorders, differences in the clinical features depend entirely on differences in the feeding, and are not to be regarded as symptoms of different diseases.*

If the limits of tolerance become narrowed, a paradoxical reaction readily takes place. If they are greatly diminished, it may be difficult to get any adequately nourishing diet to agree.

Signs of Disturbance of Nutrition from Want of Food.—Too little food interferes with the normal gain, and many deviations from the natural processes of nutrition occur. The effect of mere want of food, however, is never nearly so bad as that of exceeding the limits of tolerance. Its effects are slower as well as less severe; and, although cases of starvation resemble those of decomposition in many respects, there is the important difference that in the former the child's tolerance is relatively good and when proper food is given the reaction is normal.

The Main Varieties of Disturbance of Nutrition that occur with Artificial Feeding.—These may arise *from the limit of tolerance being passed* or *from injury due to the type of the food-stuffs.* Injuries from exceeding the tolerance of the body are not only due to absolute overfeeding. In the commonest and most important instances, the overfeeding is only relative, the disturbance being set up by amounts which do not exceed the child's physiological requirements. There are two ways in which the food may prove injurious by exceeding the limits of tolerance. (1) The combinations which are necessary to the upbuilding of the body-structure may be prevented and, in the end, destroyed; or (2) poisoning may occur because the cells of the intestinal mucous membrane are so damaged that the necessary tissue-metabolism cannot be completed. In the first, we have progressive atrophy (alimentary decomposition); in the second, toxæmia with fever (food intoxication). Which of these conditions occurs, depends in certain instances solely on the kind of food given. Decomposition sets in when the sugar in the food is scanty and the fat more or less plentiful; and intoxication, when there is much sugar and little fat. The more one-sided the mixture is in either direction, the simpler and more characteristic is the type of the disturbance. When the proportions are fairly equal, the symptoms of the two types are combined. To get a clear idea of the two clinical pictures we must begin by studying uncomplicated types of each, *e.g.*, decomposition from simple milk and cream mixtures, and intoxication from such a diet as sweetened condensed milk.

Chief Symptoms of the Three Stages of Decomposition (Finkelstein).

Stage.	Chief symptoms.	Kind and degree of Interference with tolerance.	Gain in weight.	Form of paradoxical reaction.
Typical disturbance of equilibrium from milk-feeding.	Great variations in weight, with resulting failure to gain normally. Wasting and debility. Somewhat irregular temperature curve. Soapy stools.	Lowered fat tolerance with normal tolerance of carbohydrates.	Normal gain in weight possible on a diet containing carbohydrates and poor in fat.	Little or no gain on a diet rich in fat and poor in carbohydrate. Satisfactory gain on a diet poor in fat and rich in carbohydrate.
Transition form to dyspepsia from feeding with milk and carbohydrates.	As above, but generally no soapy stools.	Lowering of fat tolerance; slight diminution of carbohydrate tolerance.	Good gain possible on scanty feeding, or on easily assimilated carbohydrates.	Tendency to dyspeptic symptoms when the food is increased.
Dyspepsia.	Similar disturbance of balance; more varied temperature and dyspeptic stools.	Lowering of fat tolerance. Greater interference with that for carbohydrates; no great interference with nutrition to be made out yet.	Little or no gain, or even loss, of weight. Increasing qualitative deterioration.	Stools and temperature normal on a restricted diet. Diarrhœa and changes of temperature when the diet is increased, especially in carbohydrates.
Transition forms to decomposition (latent decomposition).	As in dyspepsia.	As in dyspepsia, but carbohydrate tolerance still further diminished.	Moderate varying increase. What there is is due mainly to retention of fluids in the tissues.	Loss of weight on increase of food, or of its fatty or carbohydrate elements.
Decomposition.	Stools generally as in dyspepsia; but at times they may be firm in consistence. Loss of weight. Tendency to subnormal temperature. Great sensitiveness to increase of food.	Great and progressive diminution of the tolerance to all food. In well-marked cases, the low state of the nutrition can no longer be overlooked.	No gain; only breaking down of the tissues.	Wasting, subnormal temperature and slowing of pulse with free feeding. A slower loss of weight (in the milder cases at least) when the food is restricted. Great sensitiveness, especially to carbohydrates; and, consequently, a tendency to

The Stages in the Development of Decomposition.

(*Infantile Atrophy, or Food-Injury.*)

Symptoms. — In decomposition, the tolerance is very gradually destroyed, until at last the processes of nutrition come to an end altogether. *At first*, in a typical case, although the child's nourishment can no longer be fully maintained by a fat-containing diet, he manages to keep it going sufficiently from the carbohydrates in his food. This is the stage of *disturbance of equilibrium or failure to gain.* The *next stage* is that of *dyspepsia* in which signs of fermentation first appear. Now, the carbohydrates also are beginning to give him trouble and the weight begins to fall. *At last*, we have a condition of *regular decomposition*, in which the tolerance for all kinds of food progressively diminishes and the baby wastes and dies.

Stage of Disturbance of Equilibrium, or Failure to Gain.

(*Diminished Tolerance for Fat only.*)

Clinical Features.—The first stage in the process of decomposition consists in a diminished tolerance for fat only. The children in this condition are brought to us because, though they are not exactly ill, they are failing to gain weight as they should. They are pale, flabby, pasty-faced babies and, though not emaciated, are distinctly below the average weight. The mothers tell us that they are fretful and restless, and subject to slight catarrhs. They are also obstinately constipated and the stools are dry, soapy, and crumbly, and do not adhere to the napkins.

A proportion of the infants with these symptoms are merely suffering from too little food; so that when the diet is increased the stools become more normal and there is general improvement. There are instances also in which the condition is due, in some way, to careless nursing, and the children recover when they are better looked after. In another small group, the babies were thriving previously on the same diet as they are now having, until they were infected by catarrh of the air-passages or the bladder, and, whenever the intercurrent ailment comes to an end, they again begin to do well. In yet other cases, the child has been weakly from birth, owing to some form

of congenital debility, or has had his vigour lowered in some other way.

In the commonest and most typical cases that show these manifestations, however, the condition is that which Czerny described as "milk-injury," and the disturbance of nutrition has resulted from too much milk being given, and has been accompanied by the appearance of a large increase of soap, and an alkaline reaction, in the motions. The tolerance for fat in these infants is below the normal, but they are still able to deal with a considerable proportion of carbohydrate in their food, and when milk sugar or maltose are given, it is found that the usual fermentation again occurs, and the stools become acid and less soapy.

This condition Finkelstein calls "disturbance of equilibrium," because he holds that what is wrong is not really a simple "fat injury," as Czerny thought, but that the relations of the metabolism of the carbohydrates to that of the fat, and perhaps also to that of the proteins, are deranged, so that the fats are not being properly dealt with. He attributes the excellent results of breast-milk in these cases to its high sugar and low protein contents establishing a normal fermentation in the bowel, and so stopping the abnormal amount of soap in the stools; but it seems possible that there may be other reasons than this accounting for the success of breast-milk.

As the derangement continues, the infant's skin becomes noticeably dry and shrivelled, the muscular tone and vigour are lowered at one time and heightened at another. The sleep is disturbed and the baby is restless and irritable, and takes no interest in his surroundings. At first the general nutrition is little affected, but it becomes steadily or intermittently worse, and severe wasting may ultimately occur. The skin and mucous membrane are very liable to infections. While this stage lasts, there is no derangement of the heart, liver, or kidneys; but the temperature is more variable and its average level is either higher or lower than usual. Additions to the food do not cause any increase in the weight as they would have done in health, and they may even arrest any slight gain; while stopping the food is usually followed by improvement.

So long as the condition remains merely that of disturbance of equilibrium, the lowered tolerance is confined to the digestion of fats only, while that of the carbohydrates remains almost

normal. The mere stopping of the milk, for a time, and giving a chiefly carbohydrate mixture, such as dextri-maltose (Mellin's Food), or butter-milk with sugar added, may give rise to great improvement.

In cases in which there is a transition between disturbance of equilibrium and dyspepsia, the metabolism of the carbohydrates is affected as well as that of the fats, so that it is necessary to restrict the sugar as well as the cream.

Treatment.—For young babies with disturbance of equilibrium, far the best treatment is breast-feeding.

To bring about a cure by artificial feeding is a more difficult and tedious matter. Our aim is to restrict the total quantity of the food, with a relative decrease in the amount of fat taken, and with a relative increase in the amount of easily assimilable carbohydrate. The simplest way of securing these conditions is to order a mixture of cows' milk with twice its bulk of water, and cane sugar in gradually increasing proportions, until the stools become more normal in character. If, after a short time, the infant is not gaining enough weight on this, as is likely unless he is very young, the amount of milk should be slowly increased. It is not usually necessary to give any laxative, for the action of the bowels tends to become normal when more sugar is given. Completely or partially malted "infant's foods" may be useful instead of sugar, and in older children preparations of baked flour.

In cases in which dyspepsia has not yet begun, the treatment is usually very successful. The stools, weight, and general strength steadily improve; the pallor, shrivelling, and apathy disappear; and the child gradually regains his normal tolerance. Within six or eight weeks he may have become normal; but his recovery may take months, and the proportion of fat in the food should be restricted to some extent for a long time.

Stage of Dyspepsia.

(*Beginning Carbohydrate Intolerance*).

Clinical Features.—If no change is made in the feeding and the child's other conditions remain the same, the stage of simple disturbance of equilibrium may go on for a long time. If, however, more unsuitable food is given, or the bowel

damaged by impure milk, or, if some parenteral[1] complication occurs, or the child's strength is lowered in any other way, the case readily passes into the stage of dyspepsia.

When this stage is reached, intolerance for carbohydrates is added to that for fats, abnormal bacterial fermentation begins, and the paradoxical reaction characteristic of dyspepsia develops. If some ordinary normal addition is now made to the infant's bottle, the motions become larger and more abnormal, and vomiting and other stomach symptoms appear. The weight-curve and the temperature chart also show abnormal variations.

The elements in the food which disagree in these cases, in addition to fats, are the *carbohydrates* and the *whey salts*. It may now be taken as settled that fermentation in the bowel is due to the carbohydrates only, and that the casein has nothing to do with it; also that acid changes in the fat only occur secondarily to those in the carbohydrates. Finkelstein, L. Meyer, and others are of the opinion that the most harmful element in the food is the whey of cows' milk. How it is exactly that the whey upsets the digestion has not yet been finally proved; but the most probable explanation is said to be that the large percentage of salts it contains so damages the epithelium of the small intestine as to lessen its normal power to keep its contents sterile. In normal conditions, the large bowel swarms with bacteria, while relatively few are present in the small intestine. When the epithelium of the small intestine is damaged, its restraining influence on these bacteria is destroyed, so that they are able to spread up into it, and set up fermentation in the carbohydrates there. The various kinds of abnormal acids which result from the fermentation produce irritation in the bowel and so cause diarrhœa. When the irritation is not very severe, the cases represent the type which we used to call "dyspeptic diarrhœa" or "mild gastro-enteritis." When the symptoms are severe they become complicated by those of food intoxication and the clinical picture may end in "cholera infantum."

Attacks of dyspepsia are very common in bottle-fed babies, and in those previously healthy they are usually not serious. Two types of case may be distinguished (a) *dyspepsia from*

[1] An "enteral" infection is one which affects the alimentary tract; a "parenteral" one in which any other system of the body is implicated (*e.g.*, respiratory catarrh, otitis media or cystitis).

overfeeding and (b) *simple dyspepsia*, in which the food has disagreed, not because it was above the child's physiological requirements, but because his tolerance was subnormal.

Whichever of the food-stuffs is found undigested in the motions, it is always the carbohydrate fermentation that does the primary mischief. This not only irritates the bowel itself, but interferes with the assimilation of the other bowel contents, and with the intestinal metabolism. As the child gets worse, acute symptoms may develop and the case become one of intoxication; or the wasting may continue until ultimately decomposition sets in.

Symptoms.—When dyspepsia begins, the child loses colour and weight slightly and becomes hollow-eyed, restless, and irritable. The pulse, respiration, and temperature usually remain normal, but there may be a degree or two of fever. The abdomen is somewhat distended. The motions are numerous—five to eight in the day—and there is generally colic and some vomiting. If the food is increased, the diarrhœa becomes worse and the child is more uncomfortable; but, if all food is stopped and only fluids given, the stools become less frequent, the baby seems happier, and, after a day or two, the weight again begins to rise.

Dyspepsia may arise during feeding with perfectly good milk; but it will be much worse if the milk is not fresh, if the child is constitutionally feeble, if there are intercurrent attacks of respiratory or bladder catarrh, if the weather is very warm (p. 192), or the child carelessly nursed. In this condition the examination of the stools is relatively unimportant.

The Treatment of Dyspepsia depends largely on the degree of severity of the individual case. In an ordinary acute case, unless the bowels have been very thoroughly cleared out by the diarrhœa, it is usually well to begin with a dose of castor-oil and, if the attack has just begun, it is also an advantage to wash out the stomach with warm water. The food the child has been getting must be stopped at once; and, for twelve to twenty-four hours if he is strong, or for six to twelve hours if he is weakly, nothing should be given but liquids (boiled water or weak tea). After this short period of starvation, diluted milk (one part to two of water) may be begun again in about a third of the usual amount, the proper amount of fluid being made up with boiled water. It is also advisable to give a less

fermentable form of carbohydrate, such as dextri-maltose (Mellin's Food) in place of lactose, and not to give more than 5 per cent. of it. Generally, the improvement is rapid and satisfactory and, as it proceeds, the quantity of the food and the proportion of the carbohydrate can be increased.

When the dyspeptic symptoms have lasted for some time before the treatment is begun, however, this indicates greater debility and a severe diminution of the tolerance. Under these circumstances it is important to avoid doing anything that might further lower the child's strength, so that it is usually better to omit or shorten the period of starvation, and not to underfeed him more than is absolutely necessary. In bad cases, even the carbohydrates must not be very much cut down. With these limitations, recovery is usually slow; but, if the precautions are carefully attended to, the tolerance will gradually increase so that in time the child will again begin to gain. In the worst cases, it is very desirable to put the baby on breast-milk or albumin-milk (Appendix J) with the addition of dextri-maltose (Mellin's Food).

If, as we have already seen (p. 187), the child's condition is not successfully treated in the stage of dyspepsia, it will continue to get worse and his symptoms may then conform to one or other of two types. He may gradually get into a state of regular decomposition, or alimentary intoxication with fever may develop; and which of these will occur depends probably on the nature of the food given.

Decomposition.

(*Atrophy, Marasmus, Malnutrition.*)

Clinical Features. — When once the stage of dyspepsia passes into that of decomposition, the deceptive gains in weight, which sometimes take place in the former, cease to occur, and the progress is steadily downward unless regulation of the diet causes a real improvement. At first the daily loss is small, but latterly it may reach from 1 to 3 oz. a day.

As the wasting proceeds, the baby's appearance and demeanour change. The skin becomes pale, bluish, and wrinkled, the face small and shrivelled like that of an old man, the eyes

hollow and staring, and the fontanelle depressed; the lips and tongue show a dark red mucous membrane, and the child is constantly gaping for a bottle and shoving his fingers into his mouth. The abdominal wall is flaccid and toneless, so that the outlines and movements of the stomach and bowel can be seen through it. On the limbs the skin is inelastic and remains in folds when pinched up. The child is nervous, wakeful, and easily disturbed, and while awake is constantly uttering feeble, whining cries. Though not unconscious and delirious as in intoxication, he pays little attention to his surroundings, except in so far as they are connected with food. He is evidently desperately hungry, and takes the bottle with the greatest greediness.

The *stools* vary in character according to the nature of the food given. If it has contained much carbohydrate and whey, they will be loose and acid; if it has little of these substances and much protein, they are dry and alkaline. The general condition of the infant is, however, of more importance than that of his motions. The *urine* presents no characteristic abnormality. In bad cases, the *respiration* and *circulation* show signs of being embarrassed. The breathing is slow and regular, with prolongation of the expiration and sometimes a Cheyne-Stokes rhythm. The pulse also gets smaller and slower, sometimes falling as low as 80 or even 60. A degree of *subnormal temperature* is usually found; indeed, if this occurs continuously in any badly nourished infant, the onset of decomposition may be suspected. The daily variations continue as in health, but in the later stages the temperature may fall extremely low.

Infectious diarrhœa is particularly fatal to these babies, and such infection has a very slight effect on the temperature, pulse, and respiration. Terminal pneumonia is common and it may cause scarcely any respiratory symptoms.

When a baby is suffering severely from decomposition any attempt to withhold food is followed by subnormal temperature and dangerous collapse. But overfeeding is equally dangerous, for a single bottle of ordinary food may be followed by very rapid loss of weight and death from intoxication.

Most cases of decomposition are due to improper feeding, but tuberculosis and congenital syphilis may also lead to a similar condition.

As the general symptoms of decomposition are so negative in character and so easily overlooked, even in an advanced stage of the disease, the inexperienced mother often fails to recognise her child's danger, and speaks of him with satisfaction as a "wiry baby." A large proportion of *sudden deaths* in young infants, supposed to have been healthy, is due to this condition. The death may result from sudden failure of the heart or respiration, from a general nervous collapse, or from the rapid onset of acute symptoms of intoxication following an unsuitable meal.

The **diagnosis** of decomposition is easy and depends largely on the history of the case. The patient is usually a young baby, and the younger he is, the more likely is he to get into this condition. He has for weeks or months always been ailing and dyspeptic. A loss of salts, such as occurs in dyspepsia, diarrhœa, and infectious complaints, predisposes to decomposition, and so does insufficient food. Its obvious onset not uncommonly dates from a period of starvation for diarrhœa. The use of very weak condensed milk is also a common cause, and the effect of such a diet in producing retention of fluid and consequent gain in weight often encourages mothers to persevere with it to a dangerous extent, while the child is really starving. The commonest history, however, is that the child has had a mild dyspepsia which was badly treated. We often find, for example, that the patient has been given a dose of castor-oil followed by an opiate and *no change of food*; that this has been repeated several times at short intervals; and that, when no improvement followed, all food was stopped for an injudiciously long time. There may also have been various contributory causes, such as constipation, parenteral catarrhs, and careless nursing.

Treatment.—Decomposition, once it is thoroughly established, is a very difficult condition to deal with. Its onset ought, of course, almost always to have been prevented by careful management of the case in the stage of disturbance of equilibrium or in that of dyspepsia, and by doing everything possible to conserve the baby's strength.

When decomposition has developed, the diet must be carefully regulated and breast-milk or albumin-milk (Appendix J) should if possible be given. If severe diarrhœa is present, the child may be starved *for a short time only*—six or at most

twelve hours. If the stools are few, no complete starvation is allowable, and the treatment should be the same as for intoxication—stimulants, boiled water, or weak tea with a little salt. When the diarrhœa ceases—or if there has been none—food should be *begun at once*. Ten feeds of an ounce each may be given in the twenty-four hours to begin with; and every second day the daily amount may be increased by 2 or 3 oz. in the twenty-four hours, until 3 oz. are being given for every pound of the body-weight. Whatever the stools are like, food *must* be given. The quantity should be regulated by the weight-curve, and no increase must take place until that has ceased to fall. Breast-milk should be drawn off and given in a bottle, so that the amount taken can be measured; or the baby may be weighed before and after nursing.

Treatment of Decomposition in Older Children.—In older children as in infants, if there is diarrhœa, we must allow only a short period of starvation before beginning to feed. As the whey favours fermentation and the formation of irritating acids, it must be reduced in quantity as much as possible. We therefore either stop all milk, or dilute it to one-third or one-half, and we add foods such as scraped meat, eggs, and milk curd, which tend to alkalinise the bowel and discourage fermentation. The egg may be given in a custard; and carbohydrates, in the form of cereals, such as cornflour, Chapman's wheat flour, arrow-root, or well-boiled rice, are indicated. Oatmeal is less suitable, because it ferments easily; mashed potato and baked bread may also be given. A small quantity of buttermilk may be given to supply protein and salts, but it has to be used carefully because of the whey it contains. In dieting we must always remember to give sufficient water to supply the necessary amount of liquid.

The older child, like the baby, must have short starvation periods, and small amounts of food at first, very gradually increased. In enlarging the meals we should be guided by the weight-curve as well as by the appearance of the motions. The general treatment is that of intoxication, along with careful protection of the child from all dangerous outside influences, such as parenteral infections and extremes of heat and cold.

Food Intoxication.

(*Febrile Dyspepsia, Intestinal Catarrh, Summer Diarrhœa, Cholera Infantum.*)

Etiology.—As decomposition is the typical form of food disorder which results from milk-mixtures containing small proportions of carbohydrate and whey, so intoxication is that which arises when large amounts of carbohydrate, with or without whey, are given. The process rarely sets in in a perfectly healthy child, or one who has been merely failing to gain weight. It either comes on after a preliminary dyspepsia, or occurs as a complication in a child who is suffering from decomposition. It is supposed that there is an increasing formation of acid in the small intestine, which so injures the mucous membrane and interferes with the normal secretions, that the resistance of the bowel to bacterial action is lost or seriously lowered. As a result of this, new types of micro-organism are able to spread up from the large intestine into the ileum and to flourish there; and these cause breaking down of fats also and thereby further increase the acidity of the fæces.

The damaged intestinal mucous membrane also begins to allow undigested food-stuffs to pass through it and enter the circulation unchanged, in a way they cannot do in health, so that milk sugar and foreign proteins make their appearance in the urine. When undigested food-stuffs pass into the circulation in this way, they act as poisons to the tissues, and many of the symptoms in food intoxication are thus to be explained.

Although the defective composition of the diet, and the previous weakening of the bowel by disease are the main factors in determining the onset of food intoxication, there are other predisposing conditions which are also important. These are the early age and delicacy of the patient, and especially the presence of *a high mean atmospheric temperature.* It is found that when, in a town, the temperature of the air is constantly above 60° F., day and night, the mortality from summer diarrhœa is always high. In cities like Edinburgh, although the midday temperature in summer may be high, the nights are nearly always cool, and severe outbreaks of summer diarrhœa are very rare.

Clinical Features.—The first symptoms noticed are vomiting, an increase in the number and looseness of the stools, and a rise of temperature. The amount of this rise varies greatly in different cases. Its presence is significant even if it only reaches 98·7° to 99° F.; but in most instances it goes much higher and, occasionally, it may be very high indeed. When the food (especially the sugar) is stopped or restricted, the fever and diarrhœa generally come rapidly to an end and the child improves. If the case is not promptly and successfully treated, however, the symptoms may only show a slight improvement, or they may continue to get either rapidly or gradually worse, till the state of the child becomes serious.

When food intoxication develops in a severe and typical form the symptoms soon lose their purely alimentary character, and it becomes evident that every system of the body is being poisoned. When this occurs, the condition develops which is often described as "cholera infantum." The fever, vomiting, and diarrhœa continue and the infant shows signs of intense thirst, though there is little or no acute pain. The *abdomen* is generally not much distended at first; but tympanites may develop later, and the outlines and peristaltic movements of the stomach and bowels may become visible through its thin walls. Later still, the distension may pass off. The liver often enlarges. By this time, also, the *motions* have lost their fæcal characters and colour, and soon nothing is passed but colourless or slightly reddish serous fluid containing fragments of mucus. The reaction of the stools, which was acid at first, becomes alkaline from the pouring out of copious intestinal secretions; and, under the microscope, we find red blood corpuscles, desquamated epithelial cells, a few leucocytes, and innumerable bacteria. The *vomiting* is frequent and often violent; and the vomited matter soon comes to consist of nothing but tough glairy mucus, with brownish "coffee-ground" streaks in it, which point to the presence of hæmorrhagic catarrh of the stomach.

There are also signs of *failure of the circulation.* The pulse becomes increasingly rapid and small, and the child is listless and collapsed, with sunken fontanelle and hollow eyes; the extremities and the face are cold and livid and the cry very faint.

The most striking clinical characteristic of food intoxication

is the degree to which the child's *consciousness is disturbed.* This distinguishes it from the other types of food disorder. In the early stages the child is drowsy and apathetic and tosses about restlessly. Later, the loss of consciousness increases till he is in a state of stupor, and ultimately he becomes comatose and lies with half-open or staring sightless eyes, which are usually directed fixedly in one or other direction. The corneæ are dull, dry, and covered with fragments of mucus. He is now in the state described by Marshall Hall as "hydrocephaloid," because of the resemblance of the symptoms to those of tuberculous meningitis.

Early in the course of the case the face acquires the characteristic *physiognomy* of gastro-intestinal disease, with hollow eyes and drawing down of the corners of the mouth, and, before death, the Hippocratic facies may develop (p. 11). It is also interesting to note that the limbs soon cease to assume spontaneously the posture of symmetrical flexion at all the joints, which is characteristic of the healthy baby. One of them may be flexed and another fully extended, and they may either be rigid or quite flaccid.

The *respiratory disturbance* consists in strikingly exaggerated and rapid thoracic breathing ("air-hunger") which indicates the presence of acidosis. This may arise from acetonæmia or from other causes.

The *urine* is very acid and scanty, owing to the amount of fluid lost through the diarrhœa and vomiting; and albumin, casts, and less frequently sugar, acetone, and aceto-acetic acid may be found in it. The *blood* shows a high degree of leucocytosis (20,000 or even 30,000). The *weight* falls very rapidly.

It is characteristic of food intoxication that, except in the late stages, all the symptoms improve at once or disappear when the food is stopped.

If the treatment used fails to arrest the progress of the disease, the symptoms go on getting worse, and the case becomes very serious. Convulsions often occur and the child dies from exhaustion in a state of coma.

Diagnosis.—Intoxication is easily recognised, partly by the history of its onset and partly by the nature of the symptoms. The presence of pyrexia with disturbance of consciousness in any case of diarrhœa always suggests the possible presence of

intoxication; and the diagnosis is confirmed by the occurrence of the characteristic respiratory, urinary, and other symptoms. It is rendered certain if the symptoms are greatly relieved by a day of starvation.

Prophylaxis.—Food intoxication will, of course, be prevented if the feeding is carried out on right lines from the beginning, with proper hygienic precautions in the preparation of the food, in cleanliness in dealing with the napkins, and care in the nursing generally. In hot weather it is especially important to recognise any derangement of the digestion as early as possible, and to treat it at once. As the condition is so much commoner and more serious in hand-fed babies, it is always well in hot climates to arrange that weaning shall not take place during the summer months.

Treatment of Food Intoxication.—In considering the management of these cases, it is well, as Holt has pointed out, to bear in mind the main lines that Nature follows in her attempts at cure. These are clearing-out of the stomach by vomiting, restriction of food by loss of appetite, neutralisation of acidity by profuse secretion of alkaline juices in the intestine, and emptying the bowel of irritating substances by diarrhœa. We must also always remember the importance of conserving the baby's reduced strength in every possible way.

(1) *Rest and Warmth.*—The child must be kept warm and quiet, lying in bed or on his mother's lap, and not be carried about. In hot climates it is important, if possible, to have him removed to a cool place—preferably by the seaside—and nursed there in the open air as much as possible. He must be guarded from chills during the night, but lightly clad in the daytime. The fever should be reduced by sponging with warm water or better, by lukewarm baths (100° F. gradually reduced to 85° or 80° F.).

(2) *Evacuation of the Stomach and Bowel.*—The first indication is to empty the alimentary canal. For this purpose we wash out the stomach with warm water, leaving in a few ounces to allay thirst. The small intestine cannot be reached by mechanical measures, and it is usually advisable to empty it in the milder cases by means of castor-oil (1 to 2 drms. according to the age), or by small doses of calomel ($\frac{1}{4}$ gr. every thirty minutes till eight have been given, followed by milk of magnesia (2 to 3 drms.)). In very severe cases in which the diarrhœa

has been profuse, this may, however, be omitted. The colon should similarly be flushed with warm water and, if the temperature is high and the child not too collapsed, cold water may be used.

(3) *Subcutaneous Infusions.*—As, in urgent cases, the severe vomiting and diarrhœa reduce the fluids of the body to a distressing extent, because proper absorption from the bowel is not taking place, it is often important to give a few subcutaneous injections of warm saline into the back or loins. These are usually well borne and give the child great relief. From 2 to 6 oz. may be introduced at intervals of from four to six hours. Intravenous injections are also very useful (see Appendix E).

(4) *Restriction of the Food.*—No food should be given for the first twenty-four hours; but the baby may have boiled water, weak tea, or barley water freely, and it is an advantage to add a little common salt (1½ drms. to 1 pint) to favour the retention of fluid in the tissues. For one to three days after the period of starvation (according to the severity of the case) albumin water with small amounts of ordinary sugar or dextri-maltose (Mellin's Food) may be given. After this, dilute peptonised milk, without any added cream, may be given, sweetened with ordinary sugar or dextri-maltose in small quantities every two hours, or at longer intervals. If breast-milk can be obtained, it may be given on the second or third day, and it is far better than any form of hand-feeding. Albumin-milk (Appendix J), if available, is probably the best substitute for human milk. It contains less whey and carbohydrate than ordinary milk-mixtures, as well as a high proportion of protein. If the acute symptoms have subsided and the loss of weight is diminishing, the meals may be slowly increased in size until the child is getting 3 oz. for each pound of his body-weight. If the loss of weight continues, however, it is not safe to enlarge the bottles; and, if the weight is increasing satisfactorily, it is neither necessary nor advisable to do so.

(5) *Stimulants.*—When there is much exhaustion, it is always well to give a few drops (10 to 15) of brandy or whisky in a teaspoonful or two of water before each feed, or 3 to 10 minims of a 10 per cent. solution of camphor in oil may be injected subcutaneously.

(6) *Medicinal Treatment.*—Drugs are of comparatively little value in this disease especially in the more severe cases, but

some are occasionally useful. Antiseptics cannot be used in sufficient amount to have any real effect. A powder containing hydr. c. cret., sod. bicarb., and bismuth (Appendix I, Form. 10), or a bismuth mixture with or without soda (Appendix I, Form. 11 and 12), or chalk mixture, may be given every two to four hours. In mild cases and in the later stages of severe attacks, distinct improvement often follows the use of dilute hydrochloric acid (1 to 2 minims, well diluted, every two to four hours).

Opium has to be given with great caution and in very small doses to begin with. It must *never* be used until the bowel has been thoroughly emptied; and the presence of severe toxæmia (high temperature and disturbance of consciousness) is a contra-indication to its use. In many instances, it is, however, of great value in relieving pain and in controlling the excessive peristaltic action, which often takes place after each feed and hurries the food through the bowel so that it cannot be properly digested or absorbed. One should give it apart from other medicines; its effect must always be closely watched and the doses strictly regulated accordingly. It may be administered by the mouth in the form of laudanum, in initial doses of $\frac{1}{2}$ gtt. for a child of twelve months, and $\frac{1}{6}$ gtt. for one of six months; or as Dover's powder, $\frac{1}{2}$ gr. at twelve months, and $\frac{1}{6}$ gr. at six months; or in a hypodermic injection of morphine, $\frac{1}{30}$ to $\frac{1}{20}$ gr. at twelve months, and $\frac{1}{60}$ gr. at six months. The dose may be repeated in two to four hours, and may be increased or diminished according to its effect.

(7) *External Applications.*—When the patient is in a state of collapse, a mustard bath or mustard pack (p. 802) forms a useful auxiliary measure.

Digestive Disturbance from other Causes.

Although so large a proportion of the common forms of diarrhœa in infancy are due, as we have seen, simply to improper combinations of the food-stuffs in the diet, there are also some cases in which the determining cause of the intestinal derangement is to be found in some defect in the nursing, and more which are due to infection from without.

Diarrhœa from Defective Nursing.

Carelessness is, of course, a common contributory cause of diarrhœa, but occasionally, as Finkelstein observed, a number of young babies in a hospital ward, who have been doing well on a certain diet, all develop diarrhœa when their nurse is changed, although the feeding has remained exactly the same, and no carelessness can be discovered. The cause of such an occurrence is obscure; he thinks that it may possibly be due to nervous or psychical influences.

In some instances, also, an attack of diarrhœa is apparently caused by the temperature at which the baby is kept. Very warm weather may have something to do with it; but it has been found that excessive clothing is even more important, and that an over-clothed baby in mild weather is more likely to suffer from dyspepsia than one that is lightly clad when the atmosphere is very warm.

Diarrhœa from Infection, Parenteral and Enteral.

Much more commonly, the outbreak of diarrhœa in a ward is found to have followed the admission of a new case from outside. This not infrequently happens here, especially in the late summer and autumn. In these circumstances the outbreak is evidently due to infection. Infection from without may be to blame in either of two ways.

(1) It may be **parenteral**, that is to say the disturbance in the alimentary canal may be predisposed to by the acquisition of an infective condition in another part of the body, such as a catarrh (influenzal or other) in the naso-pharynx, ear, bronchi, or urinary tract, which so weakens the patient as to set up a food disorder which would not otherwise have arisen.

(2) It may be a case of **enteral** infection or **infectious diarrhœa** in which the symptoms are due to the local growth of pathogenic micro-organisms in the tissues of the child's bowel. This condition often attacks children who are in good health, and it occurs altogether independently of the nature of the food they have been getting; except that children who are on the breast are naturally very much less likely to be infected than those who are bottle-fed, and that those infants, who are getting a mixture which contains whey and a large proportion of carbohydrate, are more apt to be severely affected.

Treatment of Parenteral Infections.—Parenteral infections must receive careful treatment at the same time as the nutritional disturbance is being dealt with on the usual lines. If the infection is of such a mild character that the child's weight remains stationary, or even continues to go up during the catarrhal attack, no special treatment may be necessary. If the case, however, is a serious one and the diarrhœa severe, as is apt to happen when the child is having a large amount of carbohydrate and whey in his food, we may have either severe dyspepsia, food intoxication or decomposition, which requires the usual treatment by careful nursing and dieting; and sometimes forced feeding through a catheter may be necessary when too little food is taken voluntarily.

Infectious Diarrhœa (*Ileo-colitis*).

Etiology.—Infectious diarrhœa occurs mostly in summer, but in this climate is also especially common in autumn. It may, however, appear at any season. It is due to a variety of micro-organisms, such as the dysentery bacillus, the gas bacillus, certain streptococci, the bacillus coli, and the bacillus pyocyaneus. Little is known of the difference in the symptoms caused by the different bacteria.

Pathology.—Cases of enteral infection, unlike those of the food disorders, show definite intestinal lesions in the colon and in the lower part of the small intestine. These may consist in catarrhal enteritis, or in enlargement of the solitary glands and Peyer's patches, with or without superficial or deep ulceration; and occasionally with a formation of false membrane. There is more or less inflammatory enlargement of the mesenteric glands. Secondary lesions in other organs are not uncommon, especially otitis media and pneumonia; nephritis is rare.

Clinical Features.—In typical cases, the first symptom to occur is diarrhœa, which is generally of the dysenteric type. It sets in more or less suddenly, often in a child who has previously been in good health. The fæcal matter in the bowel is rapidly expelled, and the motions, which are small and very numerous (frequently every hour or oftener), soon come to consist of little but greenish or brownish mucus and blood; and, on microscopic examination, pus is also almost

always to be found. Occasionally fragments of false membrane are passed. The reaction of the stools is usually alkaline and the odour faint and mawkish, or, in severe cases with deep ulceration and sloughing, very offensive. Vomiting is rarely a severe symptom, and the abdomen is not usually distended. Occasionally the firmly contracted descending colon can be felt like a thick cord. There is usually no tenderness, but generally a good deal of distress from abdominal pain and tenesmus. In protracted cases, the recurrent straining is apt to cause a prolapse of the rectum.

In mild cases, the child's nutrition and his sense of well-being may not be severely affected, but, in most acute typical attacks, there is rapid loss of weight and great misery. In bad cases, toxæmic symptoms often develop—a more or less continuous high temperature with disturbance of consciousness. There is usually a leucocytosis of about 20,000.

Diagnosis.—Very acute and severe cases sometimes resemble those of intussusception. In infectious diarrhœa, however, the onset of the attack is generally not so absolutely sudden, nor accompanied by so much collapse as in intussusception, and the vomiting is a much less prominent symptom. The fever, also, is greater, and the amount of blood passed much less; while the rigid contraction of the abdominal muscles which is characteristic of intussusception, does not occur.

In less urgent cases, the symptoms may be attributed to food intoxication, but in that condition the stools are usually acid, green, and watery, and they contain much more fæcal matter and, only rarely, pus or blood in any quantity. The way in which the patient reacts to the giving of food is also important. The child with infectious diarrhœa does not show the rapid improvement from starvation nor the rapid aggravation of symptoms from ordinary feeding, which are characteristic of pure food disorders. If, after twenty-four hours of starvation, the temperature remains high and the weight is still falling, and if the numerous small motions continue and still contain blood and mucus, the case is probably due to infection and not to nutritional disturbance only.

Prophylaxis.—As the infection in these cases is either contained in the milk as it comes from the dairy, or communicated to it in some way by the hands of the nurse, it is most important, with the view of preventing its occurrence, to

see that all the milk given has been boiled, and that those who look after the children and handle their napkins are thoroughly trained in cleanly ways.

Treatment—(1) *Rest and Warmth.*—When the symptoms begin, the patient, as in other forms of acute diarrhœa, must be kept very quiet and warm, and not moved about more than is absolutely necessary; but he should have as much fresh air as possible. It is found that chills and causes of exhaustion in the course of the treatment are apt to bring on a relapse of the symptoms.

(2) *Evacuation of the Bowel.*—A dose of castor-oil (1 to 4 drms. according to age) should be given at once, or calomel in divided doses ($\frac{1}{4}$ gr. every thirty minutes till 2 grs. have been taken), followed by two or three teaspoonfuls of milk of magnesia. As the wall of the colon is the chief seat of the local lesions caused by the bacteria, it is a good plan to use irrigations of warm saline solution (two quarts at 100° to 104° F.) at intervals of twelve hours, and they may be continued with advantage once or twice daily during the further treatment of the case, unless the child is much distressed by them.

(3) *Restriction of the Food.*—All food should be stopped at once for from twelve to twenty-four hours in severe cases; but it is important that the baby should continue to take a normal amount of liquid, that he may not have the distress and weakening effect of thirst added to his other sufferings. This should be given either as boiled water or very weak tea, either of which may be taken more willingly if it is flavoured with saccharine. If the baby refuses to take sufficient fluid, it may be necessary to administer it through a catheter.

(4) *Diet.*—The proper kind of food to give depends on which variety of bacteria is causing the symptoms.

Organisms of the type of the *gas bacillus* grow rapidly in the bowel if its contents contain much carbohydrate, unless enough lactic acid is being formed to inhibit their growth. In cases due to such organisms, therefore, the indication is to lessen the carbohydrate in the food and to give organisms which produce lactic acid. For this purpose, unheated butter-milk is useful, or a milk-mixture containing protein (1·5 to 2·5 per cent.), milk sugar (3 to 4 per cent.), and no cream, along with some form of lactic acid-producing bacilli. The carbohydrate must not be

stopped altogether, for a certain amount of it is necessary to enable the bacilli to form the necessary lactic acid. In mild cases of the disease, a small percentage of cream may be allowed.

The *dysentery bacillus*, and the other kinds of organism above-mentioned, thrive either on carbohydrate or on protein; but it is only from the latter that they are able to produce harmful toxins. When they are the cause of the disease, therefore, the child should be fed mainly on carbohydrates and the proteins diminished in amount. It is also important not to starve the child for a long period, because the intestinal secretions which are poured into the empty bowel contain a large proportion of protein. Carbohydrates may be given early, in the form of small quantities of a 5 per cent. or 7 per cent. solution of milk sugar; and, later, the sugar may be dissolved in barley or rice water. Once the symptoms have begun to improve, the protein element in the food should be gradually increased by the addition of whey or boiled skim-milk. No cream should be allowed until convalescence is well advanced.

When the type of organism present cannot be ascertained, as very often happens in ordinary practice, the only thing to do is to try one or other of the above lines of diet tentatively for a short time, and be guided by the result.

In older children such things as scraped raw meat, buttermilk, boiled skim-milk, and white of eggs are useful, and later, when improvement has begun to take place, ordinary boiled milk and gruels. During convalescence, continued care is necessary, as slight indiscretions in diet are sure to be followed by return of the diarrhœa; and it is usually a long time before cream, oatmeal, potatoes, and other vegetables, or fruit, can be safely given.

(5) *Stimulants and Tonics.*—As the disease is one which causes great nervous exhaustion and irritation, stimulants are usually indicated in its treatment. In young infants 10 to 20 drops of brandy or whisky may be given, well diluted, before food. In older children port wine, and brandy and egg mixture are suitable, and lessen the child's aversion to taking food. During convalescence such tonics as nux vomica, iron, and arsenic, may be of distinct value.

(6) *Other Medicinal Treatment.*—As in the forms of diarrhœa due to dietetic errors, little advantage can usually be

got from the use of drugs. Antiseptics are of no practical value, and no form of serum has as yet proved generally successful.

When the first urgency of the symptoms begins to subside, some benefit may be derived from large doses of carbonate of bismuth (10 to 20 grs. every four hours); and at that time, as well as later, the regular use of 5-drop doses of castor-oil in emulsion (Appendix I, Form. 13) seems often to have a soothing effect on the bowel.

(7) *Special Symptoms.*—Medicines are chiefly of value in the treatment of special symptoms, and for some of these various mechanical measures are also useful.

Tenesmus should generally be treated by an opiate of some kind. This may be given by the mouth, as laudanum ($\frac{1}{8}$ to $\frac{1}{2}$ minim) or Dover's powder ($\frac{1}{8}$ to $\frac{1}{2}$ gr.), at intervals varying with the severity of the pain, or in the form of a starch enema with 3 to 5 drops of laudanum. In an older child a small cocain suppository ($\frac{1}{4}$ gr.) is sometimes given and affords great relief, but it must not be often repeated. Hot fomentations or poultices to the abdomen are useful and soothing; and hot rectal injections (106° to 110° F.) and iced enemata are also recommended.

Refusal to take fluids is sometimes a troublesome symptom. When this occurs, if giving alcohol before the feeds and sweetening the food and drink with saccharine are not successful in improving matters, it may be necessary to use tube feeding. If other measures fail and the child is suffering from lack of liquids, subcutaneous infusions of saline solution should be used.

If the diarrhœa is protracted and the motions continue to contain blood and pus, the effect of the injection of astringent and antiseptic solutions into the colon should be tried. Tannic acid solution (1 drm. to 1 pint) is also recommended. Such injections must not be persevered with if their administration leads to much struggling and excitement; and, in any case, they should not be continued for a long time unless they are having a distinctly good effect, as they sometimes lead to irritation of the lower bowel, as is shown by an increase in the secretion of mucus. If they are well tolerated they may be repeated every second day.

When *severe toxic symptoms* set in, all food must be stopped

at once for twelve hours, the bowels cleared out, and a saline infusion given. If *vomiting* occurs and persists, the stomach should also be washed out. *Hyperpyrexia* calls for external applications of cold in the form of a cold pack or cold sponging; or an enema of cold water (100° to 90°) may be given. No antipyretic drugs are allowable. When profound nervous disturbance is shown by restlessness, stupor, head-retraction, or convulsions, and does not rapidly subside when the alimentary tract has been emptied, chloral hydrate (1 to 2 grs.) may be given every few hours, or in older children a hypodermic injection of morphine ($\frac{1}{100}$ to $\frac{1}{24}$ gr.). If the fontanelle is bulging, a lumbar puncture may stop the recurrence of convulsions and other nervous symptoms, as well as being useful in excluding the existence of meningitis.

Idiosyncrasy for Cows' Milk.

In very rare instances we meet with infants who have such a morbid idiosyncrasy for cows' milk that even a few drops of it cause serious symptoms.[1] Sometimes the taking of the milk is followed, within quarter of an hour or so, by an urticarial rash along with respiratory symptoms resembling asthma. In the most severe case of this kind I have known, the baby's mother had suffered frequently from hay-fever, asthma, localised œdema, and urticaria, especially after taking bananas and other fruits, and a sister was also liable to urticaria when she ate bananas.

In other cases the symptoms are more general in character and may not begin for a considerable time (one to five hours) after the milk has been taken. The child becomes pale, drowsy, and ill at ease, vomits and becomes collapsed; sometimes there is diarrhœa, with watery motions containing mucus and curd, a rise in temperature, and glycosuria. In these cases there may be no asthmatic symptoms. Even a few drops of cows' milk are sufficient to bring on the symptoms, and any form of food made with milk disagrees in the same way.

The hypersensitiveness, which depends on a form of anaphylaxis (Appendix C), may show itself shortly after birth,

[1] Hertz, *Ugeskrift for Laeger*, 21st May 1914, lxxvi., 971; Edwards A. Park, "A Case of Hypersensitiveness to Cows' Milk," *Amer. Journ. Dis. Child.*, Jan. 1920, xix., 46.

but oftener it only begins after two or three months. It is occasionally, although very rarely, fatal. In most cases it is recovered from within a few months, but it sometimes persists throughout childhood in a modified form. The patient may or may not be able to take other forms of milk (*e.g.* goats') with impunity.

The hypersensitiveness to cows' milk, like that to white of egg, can sometimes be demonstrated by means of a cutaneous test (see Appendix C).

The treatment, when breast-milk cannot be obtained, consists in feeding the infant as far as possible on food which contains no cows' milk, and cautiously adding milk to it, beginning with a drop or less at a time, and increasing the amount slowly until tolerance is gradually established. No drugs are of any value.

CHAPTER X

ON INFANTILE SCURVY

(*Barlow's Disease*)

INFANTILE scurvy is, at the present time, not very uncommon in this country, especially in cities; and it is a most important disease to study, because it is entirely preventible, easily overlooked in its early stages, very amenable to treatment, and, when left untreated, most distressing in its symptoms and often dangerous to life.

In severe and typical cases, the disease is characterised chiefly by the occurrence of subperiosteal hæmorrhages round the long bones and elsewhere, with pseudo-paralysis and much local pain on movement, by anæmia and cachexia, and usually by sponginess of the gums. The most striking of all the clinical features is the rapid arrest of the symptoms which occurs whenever an antiscorbutic diet is given.

Although the bone-lesions are pathognomonic of the disease and are its most striking clinical manifestation, infantile scurvy is not, any more than rickets, to be regarded as primarily a disease of the bones. It should rather be described as a state of general perverted nutrition which affects, more or less, all the tissues and organs in the body, arresting growth, and leading to anæmia, local œdema, and hæmorrhages, and to disturbances of most of the bodily functions, including those of respiration, circulation, digestion, and many others, as well as causing the characteristic morbid condition of the bones. Its presence also gives rise to a definite lowering of the resistance of the tissues to infections of many kinds.

Glisson in his classical "Treatise on the Rickets"[1] gave

[1] English Translation of 2nd Edit., 1651, 249. See Clin. Lect. on Infantile Scurvy by G. F. Still, *Brit. Med. Journ.*, 28th July 1906, 186.

an excellent description of the symptoms of infantile scurvy, recognised their nature, and showed that they were not rachitic in origin but signs of a scorbutic complication. His work on the subject seems, however, to have been entirely overlooked for more than two hundred years, for most of the papers describing the morbid anatomy of the disease, which appeared during the nineteenth century, ignored its scorbutic origin (Möller, Hirschsprung, T. Smith, Gee, and others). Ingerslev in 1871,[1] and W. B. Cheadle in 1878,[2] pointed out the real cause; but it was only in 1883 that the symptoms and etiology of the condition were realised and accepted by the profession at large, as the result of a thorough and convincing investigation on the subject by Sir Thomas Barlow.[3] Since then, the disease has been generally referred to on the continent as "Barlow's Disease." During the last half dozen years much interesting and valuable work has been done on the subject in America—especially by A. F. Hess and his collaborators, and in this country by Miss Chick and those who have worked with her.

Clinical Features.—Infantile scurvy is most frequently seen in children between six and fourteen months, but it may, very rarely, occur as early as four months or even younger, or as late as two years old. In the great majority of cases, the children have been taking a scorbutic diet for six or eight months before the characteristic symptoms begin.

It is far oftener seen among the upper and artisan classes, who are given to the continuous use of proprietary infant foods, than among the very poor who cannot afford them, or who vary their use by giving fragments of potato, green vegetables, fruit, and meat which, however indigestible, are antiscorbutic. For similar reasons it is mainly a disease of large towns and is found chiefly where hand-feeding is frequent and fresh milk difficult to obtain.

Symptoms.—The most characteristic symptoms of infantile scurvy, being due to hæmorrhage, generally come on suddenly. They do not, however, set in in the midst of perfect health. Their appearance is always preceded for weeks by a slowly developing state of cachexia, which is characterised by increasing listlessness and debility with disinclination for movement

[1] *Hospitalstidende*, 1871, 121, and *Virchow's Jahresber.*, 1873, 697.
[2] *Lancet*, 16th Nov. 1878, 685; *ibid.*, 15th July 1882, 48.
[3] *Trans. Med. Chir. Soc. Lond.*, 1883, lxvi., 159.

of any kind. The child is anæmic, and in severe cases has a peculiar sallow earthy tint; he is short of breath on exertion, cries readily, refuses his bottle, and often has slimy green stools with occasional traces of blood in them. At this time also there may be tenderness on movement or pressure, especially of the feet and legs—much more than would be accounted for by the rickets which is nearly always also present.

If no change is made in the child's diet and surroundings, *pseudo-paralysis* of one of the lower limbs sooner or later develops, more or less suddenly. The infant ceases to move

FIG. 57.—Infantile Scurvy. Sub-periosteal Hæmorrhage of Right Femur.

the affected limb and screams when it is touched, from fear that it is going to be moved, and sometimes apparently owing to superficial tenderness. When the femur is the bone affected, as most frequently happens, he lies on his back with the limb abducted and rotated outwards and the knee slightly flexed (Fig. 57). The affected part is much swollen and extremely painful; the skin is tense and shiny, and there is often a condition of hard œdema. In addition to the *periosteal hæmorrhage* which causes the pseudo-paralysis, effusion of blood and œdema may occur in the muscles and intra-muscular spaces, and occasionally these tissues only are affected. There is no local rise of temperature, and the joints are scarcely ever affected.

In severe cases soft crepitus may be felt from *separation of the epiphysis*. Rarely there is a *fracture* of the shaft of the bone.

In many cases the thorax presents a remarkable and characteristic deformity, to which attention was first drawn by Sir Thomas Barlow.[1] This consists in a depression of the sternum and costal cartilages, as if they had been pushed back. It is said to be due to a series of fractures of the atrophied anterior ends of the ribs. The prominent projections which occur along the lines of the costo-chondroid junctions are apt, at first sight, to be mistaken for a rickety rosary (Fig. 57).

Much less commonly, the subperiosteal hæmorrhage takes place in the upper limb, on the pelvis or scapula, or on one or more of the ribs. In rare instances it occurs under the dura mater, but it takes place more frequently inside the orbit, in which situation it may cause considerable *proptosis*. The affection of the limbs tends to be symmetrical, that of one side following shortly after that of the other.

Along with the subperiosteal hæmorrhages, and often before them, cutaneous *ecchymoses* may take place. These have sometimes the appearance of ordinary bruises, and they are very easily produced by slight causes; and sometimes they take the form of scattered petechiæ. The vaccination scar is a not uncommon site of such hæmorrhages. Another situation in which they are early met with is over the margins of the orbit, where they are probably due to too vigorous drying of the child's face after washing. Sometimes there are ecchymoses in the conjunctivæ, and there may be marked œdema with ecchymosis of the eyelids and of the orbital tissues generally, causing protrusion of the eyes (Fig. 58).

Occasionally *epistaxis* occurs, and sometimes bleeding from the bowel. In a few of the cases, the *urine* is bright red with blood which apparently comes from the kidneys, as numerous blood-casts are present; in a majority, some red blood corpuscles can be found on microscopic examination.

As Hess has shown,[2] the hæmorrhagic tendency in infantile scurvy is not directly due to the state of the blood, which is merely one of simple secondary anæmia with relative diminu-

[1] See Articles in Keating's *Cyclopædia of the Dis. of Child.*, 1889, ii., 272; and in Graucher and Comby's *Traité des Maladies de l'Enfance*, 2me edit., 1904, t. i., 909.

[2] *Amer. Journ. Dis. Child.*, Dec. 1914, viii., 386.

tion of the hæmoglobin, but to a morbid change in the walls of the small blood-vessels, which renders them liable to rupture from moderate increase of pressure.

In addition to the more or less severe hæmorrhagic symptoms,

FIG. 58.—Infantile Scurvy in girl of 12 months. Showing proptosis, and ecchymosis of the orbits.

there are many indications of *minor hæmorrhages*, *œdema*, and *malnutrition*, in connection with the alimentary, circulatory, respiratory, urinary, and other systems of the body; and in many instances there are also symptoms of secondary septic infections of various kinds.

The *gums* are, at first, pale and normal in appearance; but on close examination, small submucous hæmorrhages are sometimes found on them, or on the vault of the hard palate. Later, if several of the teeth have appeared, the gums become red, swollen, and spongy and are often ulcerated. Even in bad cases, when there are no teeth or only one or two, the gums may retain their normal appearance. Although no change is visible in the infant's teeth at the time of the attack, it is probable that their structure is always more or less seriously, if not permanently, damaged by the disease (p. 47).

In connection with the circulatory system—the heart is sometimes found to be *dilated* or *hypertrophied*, and attacks of tachycardia have been described. These symptoms, and the *polypnœa* and *dyspnœa* which are also sometimes seen, may be due to œdema or some other disturbance of the pneumogastric nerve.[1]

The amount of the *urine* may be diminished, and when this is so, it is found to increase again on antiscorbutic treatment. Occasionally the urine contains much blood; and, in most cases, some blood-corpuscles are found in it on microscopical examination. Pus may also be present from a bacillus coli infection of the urinary tract. Even when no blood or pus is present, *albuminuria* is not uncommon.

Hess[2] has observed increased knee-jerks, superficial tenderness, and œdema of the optic discs.

In long standing cases, the disease seriously interferes with the growth both in *weight* and in *length*.[3] The weight remains stationary for weeks or months, whatever the amount of the calories in the food, unless the child has been previously underfed; and, on antiscorbutic treatment, it rises again and may be above the normal for a time. Scurvy differs from ordinary malnutrition in that it also causes a definite retardation in the growth in length. It is, however, only temporarily in abeyance, and is resumed whenever treatment is begun.

A *high temperature* is not common in infantile scurvy, and when it occurs to any degree it is generally due to some

[1] A. F. Hess, *Proc. Soc. Experim. Biol. and Med.*, 18th Oct. 1916, xiv., No. 1, 4.

[2] *Journ. Amer. Med. Assoc.*, 18th Sept. 1915, lxv., 1003.

[3] A. F. Hess, *Amer. Journ. Dis. Child.*, August 1916, xii., 152.

inflammatory complication such as acute coli-pyelitis. Pyrexia is, however, present in some cases in which no local cause can be discovered.

The *impairment of the resistance* to infection is shown by the frequency with which boils, nasal catarrhs, and bacillus coli infections of the urinary tract are met with. Coli-pyelitis is so common, relatively, in scorbutic cases that it is always well, when it is present in any case, to investigate the nature of the diet.

When scurvy occurs in children over two years old, the symptoms resemble those in adults; subperiosteal hæmorrhages are much less likely to take place, and the spongy condition of the gums is always a prominent symptom.

Etiology and Pathogenesis.—As has long been known infantile like adult scurvy is due mainly to the prolonged use of a diet which is deficient in the *antiscorbutic principle*, although other subsidiary factors have to be taken into consideration in explaining some of the symptoms.

The nature of this "principle" has till recently remained a complete mystery; but, within the last few years it has been shown to be an accessory food factor or vitamine (Water Soluble C) which is similar to, but distinct from, those already known (Appendix D). The composition of the antiscorbutic vitamine, like that of the other accessory food factors, is still unknown; but the substance has been proved by experiment to be present in all those foods which are known by experience to cure scurvy, and absent from those which do not possess this property.

The commonest causes of scurvy in young children are *condensed milk* and certain of the *proprietary infant foods*. Scarcely less important is *cows' milk which has been subjected more than once to prolonged heating*, especially if some time has elapsed between the heating process and the feeding of the baby. When good fresh milk is just raised to the boiling point shortly before it is given, it does not seem to lose its antiscorbutic property to any great extent. When it is boiled even for thirty to forty-five minutes, it rarely, if ever, produces scurvy, provided that the other conditions are favourable and that the milk is not kept long before it is used. Careful pasteurising of good milk in the home, just before it is taken, seems also to have little or no bad

effect. Since dairy-keepers have realised that the heating of milk enables it to be kept for a considerable time without getting sour, there has been a definite increase of scurvy—partly because the milk already heated in the dairy has often reached the home in a far from fresh condition, and partly because it has frequently been boiled or pasteurised a second time before being given to the baby (Heubner,[1] Neumann,[2] Sutherland[3]). In some dairies in this country there is a pernicious habit of sterilising what is left over of the day's supply, to make it keep, and adding this to the next day's fresh milk. The *peptonising* of milk greatly lessens its anti-scorbutic properties; but *buttermilk* of any kind retains them fully.[4]

Scurvy is rarely met with in breast-fed babies; but it does occasionally occur when the nursing mother is very badly fed, so that she has not enough of the necessary vitamine to pass on to the infant. The corresponding occurrence of rickets in breast-fed babies whose mothers are badly fed is far oftener met with (p. 229).

The *secondary causes*, apart from the diet, which are sometimes present and help to account for some of the symptoms, are comparatively unimportant. They consist in such conditions as a lowering of the general health from unhygienic surroundings or from the presence of any debilitating disease, and especially in *intestinal toxæmia*, which accentuates the tendency to hæmorrhage and weakens the child in other ways. When scurvy breaks out as an epidemic in an institution for infants, it is probably due to the occurrence of a general infection such as influenza—the children having been previously in a state of latent scurvy from improper feeding.

In older children scurvy occasionally sets in toward the end in prolonged cases of chronic diarrhœa. In such cases what little milk has been allowed has generally been sterilised, and fruit and vegetables, including potatoes, have been stopped altogether, so that the diet has been very defective in anti-scorbutic properties.

[1] *Berl. klin. Wochenschr.*, 1903, No. 13, 285.

[2] *Deutsch. med. Wochenschr.*, 1902, 247.

[3] *Brit. Journ. Child. Dis.*, May 1906, 229.

[4] J. D. Comrie (*Edin. Med. Journ.*, April 1920, xxiv., 214) reports very striking improvement in adult cases of scurvy in Russia from the use of milk which had simply been allowed to turn sour.

Diagnosis.—A well-marked case of infantile scurvy is easy to diagnose. In slight, chronic, and atypical cases, however, especially when the patient is suffering at the same time from some other disease, the condition is rather apt to pass unrecognised.

The possibility of scurvy being present must *always* be kept in mind whenever a child has been confined for more than four months to a diet lacking in fresh elements. If the food has contained plenty of fresh material and raw milk, scurvy may be entirely put out of the question, even though the symptoms seem almost typical of that disease. Another important point is that in all cases of scurvy there is nervousness, cachexia, and debility. If these are absent, we may generally be quite sure that the case is of some other nature.

Whenever a child, between four and eighteen months, who has been on a possibly scorbutic diet, shows *tenderness on handling of the lower limbs*, especially of the feet, without any history of injury, this should always arouse a strong suspicion of the presence of scurvy. If blood-corpuscles are found in the urine on microscopical examination, this may be held to settle the diagnosis; and the rapid and permanent improvement which always follows antiscorbutic treatment puts the matter beyond a doubt.

Among the morbid conditions which I have known to be mistaken for infantile scurvy have been fracture, acute periosteal abscess of the femur, and angioneurotic œdema of the thigh. I have also seen several cases of scurvy which had been diagnosed as poliomyelitis or rheumatism.

Treatment.—(A) *Prophylactic.*—Infantile scurvy will not occur if the milk used is fresh and is neither heated for an unnecessarily long time nor kept too long before it is given to the child. All kinds of proprietary infants' foods and condensed and dried milks are better avoided if possible, and, if used, should be discontinued after a few weeks. When it is found necessary to give any form of food which is poor in antiscorbutic properties, orange juice or some other active antiscorbutic should always be regularly added to the diet.

(B) *Curative.*—The treatment of infantile scurvy consists in substituting for the child's defective diet one which contains as large a proportion as possible of the antiscorbutic food factor, and which, at the same time, is suited to his age.

For young infants, the milk of a good wet-nurse forms, of course, the ideal diet. In most cases, however, properly prepared fresh cows' milk does very well. If its source is not above suspicion, the milk may be raised to the boiling point before use; but it should not be treated by prolonged boiling. Any heating that is done should take place in the home just before giving the milk, and not in the dairy a long time before. It is a striking fact that scorbutic babies, although they were formerly dyspeptic, can usually digest fresh raw milk quite well, even undiluted. It is not advisable to citrate the milk, nor to render it markedly alkaline in other ways, as alkalinisation has been shown[1] to lessen its anti-scorbutic power. All tinned foods must be stopped—even tinned fruits and vegetables—as these have been proved[2] to retain practically none of their antiscorbutic value owing to the heating and storing to which they have been subjected.

As even fresh raw milk is not strongly antiscorbutic, the child must take in addition some form of fruit or vegetable juice. For this purpose far the best thing to use is *orange juice*, which may be given in doses of a teaspoonful three or four times a day with water and a little sugar. Grape-juice is often given instead, but is not nearly so effective. It has been shown to have only one-tenth of the antiscorbutic value of orange juice.[3] Lemon juice is very good though it is less palatable to the babies than orange juice. The juice of fresh limes has only a quarter of the antiscorbutic power of lemon juice, and commercial lime juice is almost inert.[3] Orange juice retains its antiscorbutic properties after boiling for ten minutes, and, when carefully dried, it does not lose its efficiency. Orange and lemon juice occasionally, though rarely, cause indigestion in ordinary doses, owing to the amount of citric acid they contain; and, for that reason, they can rarely be used in large quantity. It is therefore of great interest that, when lemon juice is deprived of its free citric acid by treatment with calcium carbonate and alcohol, it retains its antiscorbutic power, while it ceases to be irritating to the digestion and can therefore be given in large amount.[4] A preparation of this kind may be

[1] Harden and Zilva, *Lancet*, 7th September 1918, 320.
[2] Campbell and Chick, *Ibid.*, 23rd August 1919, 320.
[3] Chick, Hume, and Skelton, *Lancet*, 3rd November 1918, 735.
[4] Harden, Zilva and Still, *Lancet*, 4th January 1919, 17.

expected to prove of great value in starting rapid improvement in dangerously severe cases. Another expedient which might be of use in extremely bad cases is the *intravenous injection* of orange juice. When this is boiled, made slightly alkaline to litmus by the addition of sodium hydrate and injected immediately, it has been found to be well borne and to have a strongly anti-scorbutic effect.[1]

Sometimes, when oranges are expensive, the *juice of orange-peel* may be utilised, and it has been found to be very active. When even orange-peel is not to be had, however, far the best substitute for their juice is that of *raw swedes*.[2] The clean cut surface of the turnip is grated with an ordinary kitchen grater, the pulp folded in muslin, and the juice squeezed out with the fingers. The pulp of carrots is much less anti-scorbutic than that of turnips.

The pulp of well-boiled and mashed *potatoes* is very efficient, and forms a most useful addition to the milk, especially for older infants.

Raw meat juice is sometimes useful in scurvy cases, but its action is not that of a powerful antiscorbutic. Cod-liver oil has no action on scurvy, though it may be useful for co-incident rickets. Iron may also be useful during convalescence, but generally no drugs are required.

Apart from the alteration of the diet, little treatment is necessary; but it is well to warn the parents that the child should be touched and moved as little as possible for the short time that the severe tenderness lasts. He should be wrapped in shawls and not troubled by being put into his ordinary clothes or by more washing than is absolutely necessary.

The result of the antiscorbutic diet is exceedingly striking, and the improvement generally starts within a day or two of its commencement. The appetite and vigour return, the hæmorrhages cease, the effused blood is absorbed, and the gums assume their normal appearance. Within a few weeks, in simple cases, the child seems practically well.

[1] A. F. Hess and L. J. Unger, *Proc. Soc. Experim. Biol. and Med.*, 15th May 1918, xv., 8, 141.

[2] Harriette Chick and Mabel Rhodes, *Lancet*, 7th December 1918, 774.

CHAPTER XI

ON RICKETS

THERE are few of the disorders of childhood so important as rickets, because of its frequent occurrence, the deformities and lowered resistance to certain diseases which it causes, and especially because it is generally an eminently preventible and, in the early stages, a readily curable condition. It is sometimes spoken of as a disease of the bones, and it is true that alterations in the skeleton form its main peculiarity from a morbid anatomist's point of view. From a clinical standpoint, however, these may be regarded as no more important than some of the other manifestations of the disease. Rickets, therefore, is not a bone disease, properly speaking, but a general disturbance of the nutrition which happens to affect the bones in a more characteristic manner than the other tissues.

Clinical Features.

Frequency of Occurrence.—Rickets is one of the commonest diseases of childhood. In Edinburgh between 1895 and 1900 I found that rather more than 50 per cent. of the children under three years old attending the outpatient cliniques at the New Town Dispensary and Children's Hospital showed unmistakable signs of it; and, had X-ray examination been used, a much larger proportion would certainly have been recognised. In other towns such as London, Glasgow, and Manchester, it is as prevalent or even more so. The disease is, of course, most frequent and most severe among the poor, but among the upper classes also mild cases are very common.

Age of Onset.—Rickets is a disease of infancy. Occasionally, it is said, children have been born with undoubted signs of it,

but generally no typical clinical signs of its presence can be discovered till after three or four months. It is probable that in most cases the disease begins during the first year of life, although it is certain that a large proportion of them are not brought to hospital for medical treatment until the second year, and some even later. The degree to which the characteristic bone changes take place in the thorax, back, and limbs, depends largely on the amount of movement of, and pressure on, the parts affected. Consequently, it is only when the scope of the child's activities enlarges that these deformities begin to obtrude themselves on the parents' notice and to arouse their alarm.

The clinical manifestations of the disease may, for the sake of convenience of description, be divided into (*a*) *symptoms*, that is to say, what the mother has noticed about the child—including the digestive and respiratory complications; and (*b*) *physical signs*, which the medical man discovers on examining the patient.

(*a*) **Symptoms.**—In most cases, the first symptom which the mother notices is *excessive perspiration.* This is most marked on the head, neck, and upper part of the chest; less commonly it is all over the body. It is often very profuse, so that the sweat stands in beads on the forehead, and the pillow is so thoroughly wetted that it has to be changed from time to time. The sweating is most severe when the child is sleeping, but it also occurs, on slight exertion, while he is awake; it often causes sudamina and miliaria. The amount of the perspiration may cause undue anxiety on the part of the mother, who is apt to infer from it the presence of "water in the head"!

Another symptom which is often complained of—perhaps mostly in older infants—is great *restlessness* during sleep and a constant habit of throwing off the bed-clothes. Even when the weather is cold, the child will be found again and again with his bare legs and arms lying outside the blankets. At the same time he will roll his head from side to side on the pillow until the hair on the back of it becomes crumpled and thinned. Restlessness of this sort is not found only in rickety children, but it is more common in them than in others.

Another thing which the mother often notices is the child's *disinclination to be moved.* His body and limbs seem tender, so that she can no longer use her accustomed freedom in

washing and dressing him. He has to be gently handled, or he cries. Extreme tenderness, however, is never due to rickets alone. It may be a symptom of infantile scurvy, or be caused by a subperiosteal fracture, or some other local injury.

The child shows a great disinclination to use his limbs. When he is left lying on the bed or sitting on the floor or on a chair, he keeps quite still, like an old man, and is not always on the move as a normal baby ought to be. When his feet are put to the ground, he raises them up and cries instead of trying to stand like a healthy child; and, if a relapse of rickets occurs after he has begun to walk, he at once "goes off his feet."

There is often also—especially in long-standing cases—a history of *recurrent diarrhœa*, with slimy and offensive motions alternating with constipation; or of attacks of *bronchitis* with each set of teeth or from slight exposure to cold. These are evidences of the unusual tendency to catarrh of the alimentary and respiratory mucous membranes which is characteristic of rickety children The child may also have had attacks of laryngismus or convulsions, or some other symptoms of spasmophilia (p. 436).

(*b*) **Physical Signs.**—One of the most striking points about the rickety child is that he is *flabby*. He may or may not be thin, often he is unusually fat; he is not specially anæmic, except in complicated cases[1]; but he is always more or less soft and flabby, languid in his movements, and easily tired.

No effect on the child's growth may be noticeable during the advancing stage of the disease, but if the rickets is severe, and especially if it is so at an early period, there is always, sooner or later, some *stunting* of the figure.

The temperature is not raised. If fever is present, it is not the result of the rickets, but indicates the presence of some complication.

The outline of the head may not be altered in the early stages or in slight cases; but, when the disease is severe or has lasted for any time, it generally shows the characteristic *square shape* (Figs. 32, 33, and 59 to 64). The *fontanelle* is almost invariably *larger than normal* and its closure is delayed (p. 65), so that it may be found widely open at the end of the second, or even in the third or fourth year. Its margins also are abnormally

[1] Leonard Findlay, *Lancet*, 24th April 1909, i., 1164.

FIG. 59.—Early Rickets in boy of 21 months. Commencing affection of cranium, thorax, abdomen, and epiphyses.

FIG. 60.—Severe Rickets in girl of 2½ years. Deformed thorax, large abdomen, slight curvature of arms, laxity of ligaments, in lower extremities—the feet being turned backwards without the child seeming to notice it.

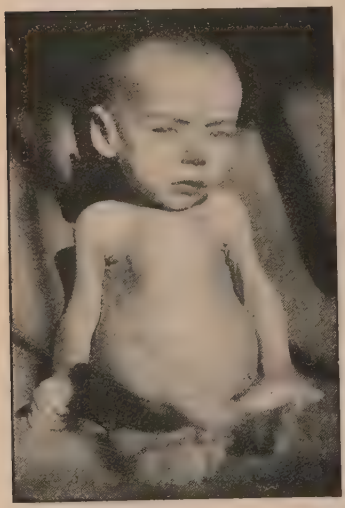


FIG. 61.—Rickets, with severe affection of head and thorax.

FIG. 62.—Rickets, with severe affection of head and thorax.

thin and yielding. The coronal and other sutures often gape a little, and their margins are soft and pliant like those of the fontanelle. *Craniotabes* of this slight form, or of the more marked degree in which there are little separate soft spots on the parietal or other bones (p. 66), is very often found in

FIG. 63.—Rickets, with severe affection of head and thorax, in a girl of 2 years.

rickets when the patients are between three and eleven months old, and it may occur earlier. After eleven months it becomes less common, but I have found it present as late as the twenty-third month. It is often the first unmistakable sign of rickets, as the beading of the ribs is sometimes difficult to make sure of in the very early stages. A certain amount of bossing is also sometimes seen, especially in the frontal and parietal regions (p. 61).

The jaws are often noticeably affected, and in time are apt to become considerably altered in shape (Fleischmann[1]). The upper is laterally compressed in front so as to form a sort of beak, while towards the back its alveoli are far apart and turn somewhat outwards. The lower jaw becomes angular instead of rounded in outline, the front being flat with angles situated at the canine teeth, and its alveolar margin tends to turn inwards. One result of this change in the form of the jaws and in the direction of the alveoli is to prevent the proper apposition of the upper and lower sets of teeth.

FIG. 64.—Rickets in a boy of 20 months. Square head, beading of ribs, and spinal curvature.

Dentition is almost always *delayed* beyond the normal time, and the intervals between the appearance of the teeth vary greatly in duration. The teeth are also apt to come *in the wrong order*, and to appear one by one, instead of in pairs as is customary under normal conditions. As we have already seen (p. 46), there is reason to believe that the causes of rickets in infancy interfere seriously with the development of the teeth and render them particularly prone to caries.[2]

The effect of rickets on the chest wall is seen in *beading of the ribs* and in various degrees of *thoracic deformity* which are considered in Chapter XXV. Rickety *curvature of the spine*, and its diagnosis from Pott's disease, have been already referred to (p. 68). The curvature arises early in the disease and soon becomes severe if the child is allowed to sit up too much (Figs. 42 and 64).

The *abdomen* in rickety children is always *protuberant*. This is owing partly to the special weakness of its muscular walls, and partly to the frequent dyspepsia and consequent accumulation of intestinal flatus. It looks even larger than it is, owing to contrast with the narrowed chest. In a considerable pro-

[1] *Klinik der Pädiatrik*, Bd. ii., Vienna, 1877.

[2] Mrs Mellanby, *Lancet*, 1918, ii., 767 ; see also J. Lawson Dick, *Lancet*, 1918, ii., 456.

portion of cases, the recurrent flatulent distension leads to a marked diastasis of the recti muscles.

Besides being displaced downwards, by the alteration in the form of the chest, the *liver* is often enlarged.

The *spleen* also is larger than normal in a certain proportion of cases. Considerable enlargement is almost always present in those cases of rickets in which there is much recent thickening of the cranial bones, and some is often found in cases where the general symptoms of the disease are rapidly progressing. There seems to be every reason to regard the cases of great enlargement of the spleen in rickety children, which were formerly referred to as "rickety pseudo-leukæmia," as instances of splenic anæmia. In the great majority of rickety children the spleen is not appreciably enlarged.

Owing to their abnormal tendency to catarrh of the mucous membranes, rickety children often show slight enlargement of the lymphatic glands, but this is probably not caused by the rickets directly.

The urine is practically normal, there being no constant abnormalities discoverable by the ordinary clinical tests.

The changes in the bones consist in enlargement at the junction of the epiphyses and diaphyses with softening and bending, and occasional fractures, of the shafts. The *enlargement at the epiphyses* corresponds to the beading of the ribs, and may often be found beginning by the third or fourth month, although it does not attain any great size until the child is old enough to use the affected limbs more actively. It is generally first and most clearly seen at the lower end of the radius. In the lower limbs, the distal ends of the tibiæ are the parts where the first and greatest enlargement usually occurs. The legs are affected later than the arms, and the epiphysial swellings of the leg-bones do not usually attain a considerable size except in children who are trying to walk.

The *bending of the long bones* depends on the amount and direction of the pressure to which they are subjected. It does not occur to any extent in infants who are kept lying flat. Bending of the arms (Fig. 60) is commonly met with in severe cases and is secondary to kyphosis. The child tends to assume a frog-like position, in which he tries to relieve his weak back muscles by bearing the weight of his head and shoulders as much as possible on his arms.

Outward bending of the legs (producing bow-legs), and also coxa vara, are commonly caused by the child standing and walking while the bones are too soft to carry the weight of the body. Bowing of the lower limbs is more apt to take place in those children whose muscles and ligaments are little weakened by the rickets. When those structures are much softened. knock-knee with flat-foot is more likely to result. Antero-posterior bending of the femora occurs when the children have

FIGS. 65 and 66.—Rickets in a girl of 6 years. Badly united fractures of clavicles, right humerus, left radius and ulna, and of ribs below the right scapula.

been carried much on the arm, or been used to sitting long on a chair with their legs hanging down; and a similar backward bending of the lower part of the tibia and fibula may occur if the child habitually sits with one leg laid over the other and the foot unsupported.

Fractures of any of the long bones may occur, and they are generally met with fairly late in the disease (Figs. 65 and 66) They are mostly subperiosteal, and in some children they are multiple, and they may be produced by very little force. Fractures of the ribs are caused by lateral compression of the chest with the hands, in lifting the child; those of the clavicle

and humerus, by lifting him by the upper arms. The bones of the forearm are sometimes bent and fractured by the child's suddenly tripping and falling while he is being encouraged to walk with the mother's hand firmly grasping his wrist. Under these circumstances, as the parent is usually right-handed, it is the child's left arm which is fractured (Fig. 65). Fractures of the leg are not common, but in the thigh they are often met with; they may be due to a fall from a chair, or other slight nursery accident. When a fracture occurs, nothing may be noticed but local pain on movement or on pressure; and it is only afterwards, when callus is thrown out, that the injury to the bone is recognised.

The peculiar conformation of the hands and fingers which is often seen in the progressive stage, especially in fat children, has been already described (p. 84).

Extreme *laxity and extensibility of the ligaments* are striking features in many cases of rickets and most characteristic of the disease. Their softness contributes largely towards the deformity in rickety spinal curvature and bending of the limbs; it often also leads to flat-foot and knock-knee. When it is present to a considerable degree, the limbs can be twisted about in a surprising way and the feet turned with the toes pointing directly backwards without inconveniencing the child (Fig. 61). When antirachitic treatment is successfully employed, this laxity of the ligaments rapidly diminishes.

Weakness of the muscles is as characteristic of rickets as bending of the bones. It may be severe in cases where the latter are but slightly affected. When this is so, the condition is sometimes spoken of as rickety pseudo-paralysis (p. 559).

Course and Duration.—The *course* pursued by a case of rickets varies considerably according to the age of the patient, his digestion, his strength, his surroundings, and the treatment employed.

The bones most affected vary in different cases. This may be partly explained by the hypothesis that rickets *tends to affect those bones which are in process of the most active development* (Baginsky[1]). Thus we find the cranium most severely affected in young infants, the thorax, vertebræ and arms in those a little older, and the lower limbs in those children in whom the

[1] *Practische Beiträge zur Kinderheilkunde.* H. ii. Rachitis. Tübingen, 1882, 50.

process is latest of developing. It is, I think, certain that *the degree of swelling present in the epiphysial ends of any of the long bones is directly proportionate to the amount they are being moved.*

The *duration* of the disease also varies indefinitely. If properly treated it may pass off in a few weeks. It may last, whether treated or not, for months or even for years. In estimating the duration of a case of rickets, however, we must distinguish clearly between signs of its actual presence and deformities due to its having formerly existed. The so-called rickety patients seen in surgical wards are often not suffering from rickets, but merely from the results of its former presence.

When the rickets is recovering, we find that the active symptoms disappear, the child becomes firm and energetic in his movements, the excessive perspiration ceases, and he sleeps quietly; the teeth begin to appear, and the fontanelle closes; any nervous and catarrhal symptoms to which he has been liable no longer recur.

Diagnosis.—Severe cases of rickets can scarcely be overlooked, and even slight cases are easy of recognition provided the symptoms are looked for. Frequently, however, the real cause of the weakness is not realised and, in consequence, proper treatment is not applied. Rickets may always be suspected if a child is late in teething or walking, and if he has a history of recurrent bronchial or intestinal catarrh. Cases of children of two or three years, in whom the muscular weakness is great and the bone changes not well marked, are sometimes mistaken for either infantile spinal or pseudo-hypertrophic paralysis. The only respects in which they resemble the latter are their peculiar waddling gait and, particularly, the way they "climb up their legs" on rising from lying on the ground.

Prognosis.—If the unfavourable hygienic and dietetic conditions which are present can be got rid of, the rickety patient generally recovers rapidly. When the disease has not been severe or prolonged, all trace of it usually passes away as the child gets older; and, by eight or ten years, even tolerably severe cases may show no symptom of their former affection.

Although rickets is not itself a fatal malady, its presence may constitute a dangerous complication in cases of respiratory disease. This is due partly to the way in which the softened ribs tend to collapse, and partly to the weakness of the muscles.

"**Late Rickets.**"—Occasionally, after some weakening disease such as influenza, measles, or whooping-cough, a child of three or four years will begin to show marked signs of rickets apparently for the first time; and a few cases beginning at nine, eleven, thirteen, or even seventeen,[1] have been put on record. These cases are spoken of as "late rickets" or "rachitis tarda." It is generally thought that they are due to a recrudescence of rickets which had previously been present. Such pathological examination as has been made seems to prove that the condition is indistinguishable from rickets. Apparently, however, the dietetic causes are somewhat different from those of the ordinary infantile disease. In the meantime our knowledge of this disease is extremely defective.

The treatment consists in careful attention to the digestion, which is usually profoundly affected, and to the diet, in improvement of the hygienic conditions, and in the administration of tonics. Its result in cases that are at all severe is always very unsatisfactory.

"**Fœtal Rickets.**"—The existence of real fœtal rickets is doubtful. The name has generally been used for cases which are now described as achondroplasia or osteogenesis imperfecta.

Etiology and Pathogenesis.

Although rickets is so common, its causes and the ways in which they act are still only imperfectly known. A good deal of valuable information on the subject has, however, been obtained during recent years.

Many of the older theories, such as that it is due to a want of lime and phosphorus in the food, or to lactic acid circulating in the blood and decalcifying the bones, have long been given up. Recently somewhat different "acid hypotheses" of the causation have been put forward and advocated in an interesting way by Stoeltzner[2] and E. Pritchard.[3] Experimental and clinical observations on certain factors in its etiology have also been published by Nöel Paton, L. Findlay, and their

[1] See case published by Dr Alex. James, *Scot. Med. and Surg. Journal*, Jan. 1897, 22.

[2] *Oxypathie*, Berlin, 1911, 43.

[3] *Brit. Med. Journ.*, 1919, ii., 627.

collaborators[1]; and E. Mellanby[2] has investigated the relation of diet to the disease by a series of experiments on puppies which are of great interest and practical value.

The conditions which clinical observation has led us to associate more or less closely with the occurrence and continuance of rickets fall mainly under five heads: (*a*) a lowered state of the health of the mother during her pregnancy; (*b*) unfavourable home conditions; (*c*) lowering of the child's health by antecedent infective disease; (*d*) digestive disturbances; and (*e*) defects in the diet. The disease has also been attributed occasionally to microbic infection; and some unsuccessful attempts have been made to prove that its origin is connected with defective action of one or other of the endocrine organs, such as the thyroid, thymus, or suprarenals.

(*a*) **Ill Health of the Mother.**—There is no reason to believe that a father and mother who have themselves suffered from rickets are more likely than other people to have rickety children; or that ill health of the father has any special effect in predisposing the child to suffer from the disease. It is generally held, however, and I believe on good grounds, that if a mother is anæmic or feeble from some cause during her pregnancy, her child will be more likely to develop rickets than if she had been in good health at the time. In the case of poor families, the obvious fact that ill health in the mother interferes with her care of the child, makes the value of such an observation very difficult to estimate. In the well-to-do classes, however, this difficulty does not usually arise; yet among them likewise we not uncommonly observe a special tendency to rickets in the children of ailing mothers, which is otherwise difficult to explain. It is also found in better-class households, as well as among the poor, that the youngest children in large families, who are born when the mother is approaching the menopause, are apt to become rickety; although the older ones, brought up under similar treatment, have shown no tendency to develop the disease.

Prematurely born and twin children seem to be especially

[1] *Brit. Med. Journ.*, 1918, ii., 625; and *Med. Research Committee, Spec. Rep. Series*, No. 20, 1918.

[2] *Journ. Physiol. Proc.*, 52, xi., 26th Jan. and 14th Dec. 1918; *Lancet*, 1919, i., 407.

prone to rickets, probably owing to their having been inadequately nourished *in utero*. It has also been shown that the strong tendency to rickets, which is shown by negro children in New York City, is probably due to their mother's defective diet.[1]

(*b*) **Unfavourable Home Conditions.**—The want of sunshine and fresh air is certainly an important contributory cause of rickets. Many children who spend most of the day out-of-doors escape the disease entirely, although their diet would probably have caused it had they been much confined to the house. City children are thus in much greater danger of becoming rickety than those who are country bred.

As the result of an extensive series of experimental and clinical observations in Glasgow, Nöel Paton and Findlay and their co-workers[2] are of opinion that, whatever is the essential primary cause of rickets, improper housing and absence of facilities for open-air life, as well as defective parental care, strongly favour the onset of the disease. They hold that it is mainly by improving the housing conditions that the disappearance of the disease can best be brought about. Weak health on the mother's part they regard as only of etiological significance in so far as it interferes with her care of the children. They are also, unlike most other authorities, inclined to think very little of the influence of injudicious feeding, compared with that of defective hygiene and maternal care, and to attribute far more etiological importance to the want of fresh air and exercise. The effect of too little bodily exercise is a point to which Findlay attaches special importance.[3]

(*c*) **Antecedent Infective Disease.**—Any debilitating infective disease may predispose to the onset of rickets, or, if already present, may cause it to become much worse. Congenital syphilis, for example, is apt to act in this way, although it does not always do so; but it is certainly an error to regard

[1] Hess and Unger, *Journ. Amer. Med. Assoc.*, 30th March 1918, lxx., 900.

[2] D. Nöel Paton, L. Findlay, and A. Watson, *Brit. Med. Journ.*, 1918, ii., 625; also Margt. Ferguson and L. Findlay, "A Study of Social and Economic Factors in the Causation of Rickets," *Medical Research Committee, Spec. Rep. Series*, No. 20, 1918.

[3] *Brit. Med. Journ.*, 4th July 1908, ii., 13.

it, as Parrot did, as an essential cause of rickets. It is probable, however, that congenital syphilis sometimes modifies the character of some of the bone-lesions in rickets—increasing, for example, the tendency to craniotabes and bossing of the cranial bones. One sometimes finds a severe recrudescence of rickety symptoms occurring during convalescence from an attack of measles, whooping-cough, or influenza.

(*d*) **Digestive Disturbances.** — Prolonged gastro-intestinal derangements are very apt to lead to rickets. They not only weaken the child's general resistance; but, by preventing the absorption and assimilation of some of the necessary elements of the diet, have the same effect as improper feeding. Paton, Findlay, and their coadjutors found that 33 per cent. of the rickety children they examined had suffered from diarrhœa, while only 11 per cent. of those who were not rickety had done so.

(*e*) **Defective Diet.**—For long it has been held by most of the leading authorities on the diseases of children that improper feeding is the most important, and probably the only really essential, element in the causation of rickets. We find dietetic errors, or some digestive derangement, which may presumably have had a similar effect, in practically all cases; while the other causes already mentioned, though certainly important to some extent, have not invariably been present. The experience of all children's hospital outpatient departments has seemed to show that the defects in the diets most often associated with the disease are a *lack of animal fat, too little protein*, and *an excessive amount of farinaceous food.*

These conclusions have been supported by our experience of the circumstances under which rickets commonly appears. We find it frequently, for example, in children who are being fed either on much diluted cows' milk, on condensed milk, or on some other form of food in which there is too little animal fat and protein. When it appears in breast-fed infants, the mother has generally been nursing too long, so that her milk is poor in quality and deficient in fat, in protein, or in both of these constituents. It is also frequently found in children about the time of weaning when the breasts are supplying too little milk, while the mothers are trying to make up for this by giving a quantity of unsuitable farinaceous food.

When the presence of accessory food factors in all normal diet was discovered and the importance of a lack of these bodies as a cause of disease was realised (see Appendix D), attention was naturally directed to the possible significance of this question in the etiology of rickets; and the great value of cod-liver oil in its treatment, and the occasional association of the disease with scurvy, further suggested to various workers[1] that rickets as well as scurvy might prove to be a deficiency disease.

The recent admirable experimental investigations on the causation of rickets undertaken by E. Mellanby for the Medical Research Committee[2] seem, so far as they have gone, to prove that this suggestion was fully justified; and that the reason why certain well-known articles of diet produce rickets is that they are deficient in a special accessory food factor. He has shown that this antirachitic vitamine is similar to, and probably identical with, that already known as Fat Soluble A. It is not allied to either of the other recognised accessory food factors, for neither orange juice (antiscorbutic vitamine) nor yeast (Water Soluble B.) prevent the development of rickets.

The investigations were carried out on puppies which were fed on one or other of four standard diets which had been found to cause rickets. These were as follows:—

Diet I.	Diet II.	Diet III.	Diet IV.
Whole milk, 200 c.c. Oatmeal porridge. Rice porridge. NaCl, 2 gr.	Whole milk, 175 c.c. White bread. NaCl, 1 to 2 gr.	Separated milk, 175 c.c. White bread (70% wheaten). Linseed oil, 10 c.c. Yeast, 10 grm. NaCl, 1 to 2 gr.	Separated milk, 250 to 350 c.c. White bread (70%). Linseed oil, 10 c.c. Yeast, 5 to 10 grm. Orange juice, 3 c.c. NaCl, 1 to 2 gr.

To these diets other food-stuffs were then added, and the effect of the addition on the development of the disease was noted. Working in this way, Mellanby was able to divide the ordinary foods into those which had no effect at all in pre-

[1] F. G. Hopkins, *Analyst*, 1906, xxxi., 395; and C. Funk, *Die Vitamine*, 1914.

[2] *Medical Research Committee*, *Spec. Rep. Series*, No. 38, 1919, 82; *Journ. Physiol.*, Proc. 52, xi., 26th Jan. and 14th Dec. 1918; and *Lancet*, 1919, i., 407.

venting rickets, and those which had this property to a greater or less extent. Some of his results are shown in the following table:—

Substances not preventing rickets in puppies.	Substances preventing rickets to varying extents in puppies.
Bread *ad lib.*	Whole milk (500 c.c. a day).
Oatmeal and rice.	Cod-liver oil.
Separated milk *ad lib.*	Butter.
Yeast 10-20 grm. a day.	Suet.
Orange juice, 5 c.c. a day.	Olive oil.
Linseed oil.	Lard.
Hydrogenated fat.	Cotton-seed oil.
Calcium phosphate and sodium chloride.	Meat and meat extracts.
Meat protein and milk protein.	Malt extract.

From this table we see that the antirachitic factor is present mainly in various forms of fats and extractives; and this is what might have been expected from the results of clinical experience. Any foods which do not contain the antirachitic factor are positively rickets-producing; and with a view to preventing the disease, the infant's diet should contain as much as possible of that substance.

Most of the animal fats and vegetable oils (except linseed oil) prevent its development. Cod-liver oil is the most efficacious form of animal fat for this purpose, and vegetable oils are much less antirachitic than such things as butter and suet. Fresh milk has more effect than butter.

A mere increase of the calcium in the food has apparently no effect at all in preventing the development of rickets.

Hess and Unger have shown in an interesting and convincing way that the regular administration of cod-liver oil has a most powerful effect in preventing rickets in the negro community in New York.[1]

Although rickets seems primarily due to a lack of the special accessory food factor, it is not a simple deficiency disease like beriberi. Its development requires another factor also, namely, the *presence of active growth* and, "the better the animal grows on a rachitic diet, the more easily is rickets produced, or rather the more difficult is it to stop." A rapidly growing

[1] "Prophylactic Therapy for Rickets in a Negro Community," *Journ. Amer. Med. Assoc.*, 10th November 1917, lxix., 1583.

animal, therefore, needs more antirachitic vitamine to prevent it from developing the disease. Meat and meat extracts have a specific power of stimulating the total chemical changes in the body, and their action in promoting growth is far in excess of any influence they exert because of the amount of antirachitic food factor they contain. Their presence in the food makes its antirachitic vitamine more effective, so that a slightly rachitic diet becomes safe if enough meat is added to it. Vegetable juices are also apparently useful. It is probable that only a small amount of the antirachitic food factor is necessary to enable an animal to grow at a normal rate, but that a considerable amount is required in order to keep the growth on right lines.

Treatment.

(*A*) **Prophylaxis.**—Although the causation of rickets has not as yet been fully elucidated, enough is known about it to prove beyond all question that it is a preventible disease and one which we may hope will in the future cease to exist in all well-regulated communities.

Its prevention depends on the maintenance of the mother's health and efficiency; on the provision of proper hygienic conditions in the home; on the prevention, as far as possible, of acute ailments of all kinds during infancy, and on their care during convalescence, and especially, on the regulation of the child's diet on physiological lines.

(1) *Maintenance of the Mother's Health and Efficiency.*—Care of the mother during pregnancy and lactation is important in all ranks of life; and it becomes much more so when any of the former children have developed rickets, and in the case of mothers who are nearing the end of the child-bearing period.

The mother's diet requires attention, for the breast-fed baby is dependent on her for the necessary supply of accessory food factors and she has to obtain this entirely from her food. It is therefore essential that she should have plenty of articles, such as milk, butter, eggs, suet, and green vegetables, which are rich in the vitamine required, and that suitable forms of animal fat should not be replaced by cheap varieties of margarine composed of vegetable oils and hydrogenated fat.[1]

[1] See Hess and Unger, "The Diet of the Negro Mother in New York City," *Journ. Amer. Med. Assoc.*, 30th March 1918, lxx., 900.

It is also important that the milk taken by the mother, as well as that given to the baby, should be obtained from cows that are properly fed and looked after (*v. infra*).

Among the poor, a lack of personal care and attention on the mother's part is a causal factor the influence of which can scarcely be over-estimated. Such inefficiency may be largely due to physical weakness; and, when this is so, timely attention to her health and the prevention of overwork may make all the difference. The neglect of the children often depends mainly on causes which lie outside the sphere of the physician, such as stupidity, carelessness, intemperance, and the inevitable limitations of extreme poverty. Recent experience in many towns has shown, however, that these evils can often be efficiently dealt with by the personal instruction and supervision of competent child-welfare visitors and almoners; and much good may be expected in the future from the further development of such agencies. Everything that helps toward increased efficiency of the mother is of great value in the prevention of rickets.

(2) *Improvement of the Hygienic Conditions.*—In addition to raising the standard of the mother's efficiency, improved housing may do much to prevent the development of rickets in a family. Rickets is commonest in dark, dirty, crowded dwellings, and in congested localities. The great advantage in this respect of proper housing is illustrated in a striking way in Miss Ferguson's interesting statistics regarding the very small proportion of rickets found in the model villages of Bourneville and Port Sunlight, compared to that in the larger towns.[1]

It is of special importance that the home should be so situated that in fine weather the young children can have their rest and their exercise as much as possible in the fresh air and sunshine. The custom of living in "flats," so prevalent among the working classes in Scotland, is probably responsible to a considerable extent for the frequency of rickets among them. Under the conditions which prevail in these high tenement houses, free access of the young children to the open air is rendered peculiarly difficult, and their health is sure to suffer unless the windows are more freely opened than they usually are.

[1] *Loc. cit.*, p. 85.

Thorough open-air treatment is as good for rickets as it is for tuberculosis; and the fact that rickets is less common and severe in Edinburgh among hospital outpatients than it used to be thirty years ago is, I believe, largely due to the open-air treatment of phthisis having removed the old-fashioned prejudice against open windows.

(3) *The Prevention and Care of Acute Ailments.*—The causes of catarrhal and dyspeptic disorders must be carefully guarded against; and when such ailments occur, they must be checked as soon as possible. After severe illnesses, especially measles, whooping-cough and influenza, nothing should be left undone to ensure rapid and complete convalescence.

(4) *Regulation of the Diet.*—As clinical experience has shown that the main cause of rickets lies in defects in the feeding, the most important means we have of preventing its development consist in regulation of the diet on normal lines. The ordinary diet of infancy contains plenty of the accessory food factors required; and, even in surroundings that leave much to be desired, there is probably little reason to fear that he will become rickety, if he is healthy to begin with and is properly fed.

(*B*) **Curative Treatment.**—The therapeutic indications to be observed in the case of a child who has developed symptoms of rickets may be summed up as follows:—He should have more fresh air and sunshine. His digestion should be attended to, his diet regulated, and certain tonic measures used. Any severe symptoms and complications present may require special treatment, and means have to be taken to prevent and relieve bony and other deformities.

We shall now consider briefly how these indications may best be met.

(1) *Fresh Air and Sunshine.*—The child should be taken out of doors twice daily at least, and for as long as possible. In the case of the poor, it is often a good plan to have the baby left in the open air in his perambulator for a large part of the day, provided the weather is at all suitable. He must, of course, be warmly clad, because a rickety child, owing partly to his excessive sweating and general debility, is particularly liable to chills. If he cannot be taken out, he should be kept in the sunniest room available and near the window, which should remain widely open day and night. Where the

parents' circumstances permit of it, a change to the seaside is desirable.

The question as to how much exercise should be allowed to rickety children is not yet fully decided. It is particularly characteristic of babies with progressive rickets that they are very loth to use their limbs. When we consider the softness of their bones and ligaments, how easily these are seriously damaged by being bent and overstretched when any weight is put upon them, and how active movement of a limb increases the enlargement of its epiphyses, it certainly looks as if the disinclination for movement were a provision of Nature to prevent and lessen deformities. In view, however, of L. Findlay's observations[1] that puppies whose movements are abnormally restricted suffer more severely from rickets than others, on the same diet, who are encouraged to active movement, this view may possibly require further consideration.

In the past, it has been customary to order a large amount of rest for all rickety children, and to keep bad cases always lying. Our instructions in this matter have very often been disregarded, so that there have been many opportunities of observing the results of their neglect as well as those of their observance. So far as my experience goes, children whose digestion is good and whose muscles and ligaments are not much weakened by the disease, sometimes do very well when allowed to run about freely. Their freedom from restraint increases their interest in life, and consequently their general health and vigour; and the bowing of the legs and thighs, which is the chief deformity present in such cases, usually recovers in time in spite of, and probably to some degree because of, the exercise. In the case of the much larger number of rickety children, however, in whom the digestion is feeble and the muscles and ligaments very extensible, the increased exercise seems to have only a bad effect and to lead to general exhaustion and to severe and often permanent distortions, such as knock-knee, flat-foot, and spinal curvature.

My belief is therefore that in relatively vigorous rickety children who have begun to recover from the disease and want to move about, carefully regulated exercise, short of fatigue,

[1] *Brit. Med. Journ.*, 4th July 1908, ii., 13.

is beneficial; but that those who are weakly and dyspeptic, should certainly be kept very quiet. Severe cases should be kept constantly lying until definite improvement has set in, as is shown partly by their increasing desire to get up.

(2) *Attention to the Digestion.*—Before making any great change in the diet or giving tonics, it is advisable to consider the state of the digestion, and if necessary to take means to improve it. A short course of soda, with rhubarb or with nux vomica and gentian, will often so strengthen the digestive power as greatly to enhance the efficiency of the dietetic treatment. A few doses of grey powder will sometimes be found to facilitate considerably the assimilation of the increased fat in the food. Should diarrhœa or vomiting be present it is, of course, necessary to stop them before giving cod-liver oil or otherwise increasing the fat.

(3) *The Diet.*—It is important to see that the meals are reasonable in amount and digestibility and are given at suitable intervals. The main thing, however, is to make sure that they contain an adequate proportion of fat and animal proteid in such forms as can be easily assimilated.

Should the patient be a young baby on the bottle, a wet nurse's milk is the ideal food for him. Short of this, however, careful feeding with cows' milk is often successful. When the child is unable to digest the full amount of cows' milk sufficiently well, the addition of raw meat juice to his bottle is often a great advantage.

In the case of children during the second year of life, the first point is generally to see that enough milk is being given; for it is certain that milk should form the chief food for some years after weaning. Mothers who are otherwise sensible will often be found giving their infants less than half a pint of milk in the twenty-four hours when they ought to be having three times that amount.

It is also of importance, if possible, to obtain the milk from cows that are properly housed and fed, for it has been shown that, when cows are stall-fed on oil-cake, their milk contains far less of the accessory food factor than when they are feeding out of doors on good grass (Mellanby). This is probably one of the reasons why rickets is more prevalent in winter and spring than in summer.

When the children are old enough for a more mixed diet,

butter and dripping are very good for them, and are much to be preferred to margarine and other preparations of vegetable oils; and the regular administration of cod-liver oil, either plain or in emulsion (Appendix I, Form. 14), is practically always advisable. Yolk of egg, either beat up with milk or given in some other way, is an excellent addition to the food. It provides organic compounds of phosphorus, as well as protein and fat, in forms that are usually well digested. Extra cream is also often useful.

The other important indication in the feeding of rickety children is to see that they are not having an excessive amount of bread, potatoes, or other starchy foods, and that the digestion is not being upset by frequent mouthfuls of "whatever is going." Oat flour or well-boiled oatmeal porridge and baked bread are probably the best forms of farinaceous food, and plain bread the worst.

Proprietary infant foods have generally the great disadvantage that their preparation has destroyed much of the accessory food factors in their composition.

(4) *Tonic Measures.*—The value of alkaline tonics in improving the digestion has already been referred to. If anæmia is present, iron may be very useful. Often, however, it only upsets the digestion; and generally it is unnecessary because the condition of the blood rapidly improves when the diet is regulated.

Uncombined phosphorus has been strongly recommended by Jacobi and Kassowitz as having a sort of specific action in rickets. Although others have failed to substantiate this claim, phosphorus certainly seems to do good in some cases, if care is taken not to disturb the digestion. It is usually best given dissolved in cod-liver oil, but if preferred may be prescribed separately (Appendix I, Form. 15 to 17). About $\frac{1}{200}$ gr. may be taken thrice daily after food. Combined phosphorus in the form of mineral phosphates has long been proved to be of no value, as these salts are passed unchanged in the motions.

Cold douching does a great deal of good in most cases of rickets (p. 800). It is specially indicated in cases where there is great muscular feebleness, and when spasmophilia is present. The frequent use of cold water in this way has the great advantage that it renders the child much less susceptible to cold, and thus enables him to be more freely exposed to the open air

without taking chills. Persevering massage of the limbs, and specially of the back and chest muscles, is of great value.

(5) *Treatment of Symptoms and Complications.*—It is always to be remembered, with regard to the symptoms and complications of rickets, that their management is mainly that of the diathetic condition, and that the local treatment is only of secondary importance. Thus we find that profuse sweating, sleeplessness, and restlessness, digestive disturbances, loss of appetite, constipation, bronchial catarrh, and the manifestations of spasmophilia, are all rapidly and permanently improved when thorough antirachitic treatment is carried out—even if no other special measures are taken.

It is sometimes, however, desirable to make use of local treatment also. When the sweating is severe, it sometimes seems to be benefited by oxide of zinc (1 to 2 grs.). When spasmophilia is present, special treatment is desirable (p. 446); and the ordinary measures indicated in digestive and respiratory disorders should, of course, not be neglected.

(6) *Prevention and Relief of Deformities.*—We must remember that, while rickets softens the bones and ligaments, it does not bend or stretch them. That is done by the weight of the body and by other mechanical forces acting in various directions on the softened parts. While, therefore, we are trying to arrest the rickety processes which are softening the body, we must take care to prevent, as far as possible, all postures and actions on the child's part which produce deformities and interfere with Nature's attempts to cure them.

As we have already seen, it is probably good for the rickety child to have some carefully supervised exercise when the bones are beginning to harden and the muscular vigour to return; but, until recovery has thoroughly set in, it is certainly advisable to be very cautious in this matter, lest we allow permanent deformities to be produced. He must not, for example, be allowed to sit up for long, for fear of the development of kyphosis; his nurse must not carry him always on the same arm, lest he acquire a lateral curvature; and, if he is allowed to walk, he must not get into the habit of standing for long, holding on to a chair or some other support. If he is very rickety, he should always, at first, be kept lying constantly in bed or on a pillow, and not be allowed to sit up at all.

When he has to be prevented from walking, the application

of lateral wooden splints, reaching from the pelvis to 4 inches below the sole, may be useful as a means of preventing standing altogether. No form of steel or other apparatus which permits the child to walk about is of much value in preventing the bending of the limbs.

Rickety deformities of the chest have a striking tendency to lessen as the child grows older and stronger. This improvement can be much accelerated and increased by the persevering use of musical drill and other similar exercises of the arms and trunk.

CHAPTER XII

ON THE CLINICAL EXAMINATION OF THE ABDOMEN AND SOME DERANGEMENTS OF THE DIGESTIVE SYSTEM IN OLDER CHILDREN

Physical Examination of the Abdomen.

Inspection.—In the early years of life the abdomen is relatively large. This is accounted for to some extent by the size of the liver, and it is rendered more noticeable by the comparative narrowness of the child's thorax.

Abnormal enlargement of the abdomen is common. It may be due to increase in size of one or more of the organs, to ascites, or to tumour. Much the commonest cause, however, is flatulent distension of the bowel or stomach.

On inspecting a distended abdomen we should note whether the enlargement is uniform or confined to one region only, such as that of the stomach, colon, or small intestine. In cases of chronic distension it is also well to be on the outlook for *abdominal patterns*.[1] These are formed by the occasional standing-out in rigid spasm of the distended small intestine, colon, or stomach, and by the visible occurrence in them of vigorous peristaltic waves. This is a very important symptom, because it generally indicates not only that the viscus in question is dilated, but that its muscular wall has become hypertrophied as the result of long-continued overaction due to interference with the free passage onward of its contents. In older children in this country, far the commonest cause of this obstruction is abdominal tuberculosis, which acts either by producing narrowing of the bowel from the cicatrisation of ulcers, or its compression by peritoneal adhesions

[1] John Wyllie, "The Diagnostic Value of Patterns of Abdominal Tumidity," *Edin. Hosp. Rep.*, 1894, ii., 19.

(Fig. 246). Such obstruction is commonest in the ileo-cæcal region; and evidence of its presence calls for early surgical assistance—either excision of the narrowed portion of gut, or more usually, the formation of an anastomosis between the portions of bowel above and below it. Visible intestinal peristalsis is also a characteristic phenomenon in cases of congenital hypertrophy of the colon (Fig. 70) but in very young infants it more commonly indicates the presence of congenital atresia or stenosis of some part of the intestine (Fig. 68).

When well-marked visible peristalsis of a distended stomach is observed in an infant, between ten days and four months old, this almost always signifies the presence of congenital hypertrophy of the pylorus. To be characteristic of this condition, however, the peristalsis must be very distinct and forcible; for in many wasted babies and older children with no obstruction, the normal movements of the stomach and bowel are easily visible owing to the thinness and tonelessness of the abdominal wall.

On inspection of the abdomen we must also notice if there is any abnormal dilatation of the superficial veins, if the umbilicus is protruding, and if there is any redness of the skin round about it, as is common when an abscess is forming from abdominal tuberculosis. In cases of wasting in young children, the skin of the abdominal wall often presents little colourless elevations scattered over its surface. These look like raised nodules; but on touching them they are found to be quite soft; they are caused by dilated lymph-spaces. In severe and protracted cases of diarrhœa or tuberculosis, we sometimes find an extensive eruption of small ecchymoses in the skin of the abdominal wall. These indicate a dangerous though not necessarily fatal degree of weakness.

Retraction and hollowing-out of the abdomen are significant indications of intra-cranial disease (Fig. 177); they also occur to some extent in acute acidosis.

Palpation.—There are few methods of clinical examination so important in childhood as the palpation of the abdomen; and, unless tenderness is present, there is none that is less objected to by the patient, provided it is carried out tactfully *with warm hands*. It is a part of the investigation of the case which must never be omitted, even although no abdominal symptoms are complained of.

In many cases it is advisable to begin the palpation by slipping the hand under the clothes or bed-clothes, before the child has been disturbed by any other examination. While this is being done, his attention should be turned as much as possible in other directions. If we succeed in this, it will usually be easy to ascertain whether pressure gives rise to any real pain, which is always a valuable fact. If, however, by roughness or cold hands his attention is drawn too much to what we are doing, we shall get little information and the chances of error are considerable.

It is always important to judge of the presence or absence of tenderness by observing whether the child winces on pressure being applied, and not by asking him if it hurts.

If pressure on any part causes pain, we have next to investigate the exact site and superficial area of its distribution; and we must also endeavour by gently pinching up the skin between the forefinger and thumb, to discover to what extent the tenderness is situated in the skin, in the subcutaneous tissue, and in the muscles. This line of enquiry does not, indeed, give us important information so often in children as it does in adults, because many of the abdominal lesions (such as gastric ulcer, gall-stones, and urinary calculi) which give rise in later life to such a *viscero-sensory reflex*,[1] only rarely occur in childhood. We may, however, occasionally obtain interesting and valuable light from it on the diagnosis in such conditions as acute pyelitis, tuberculous bowel lesions, subphrenic abscess, appendicitis, and other localised areas of inflammation in the abdominal cavity. Areas of extreme tenderness are also sometimes present on one or other side of the abdomen in cases of basal pneumonia or diaphragmatic pleurisy. In severe cases of general peritonitis the sensation may be dulled to such an extent that no pain is caused by pressure.

The *viscero-motor reflex*,[2] that is to say the persistent involuntary contraction of muscle in the abdominal wall due to a nervous stimulus passing from a viscus, is often met with in children, and may be very useful in drawing attention to disease of the abdominal organs. It must be distinguished from the passing, involuntary contraction of the abdominal

[1] James Mackenzie, *Symptoms and their Interpretation*, 1906, 59.

[2] *Ibid.*, 67.

wall which accompanies rough handling or tickling, and also from the voluntary stiffening of the abdomen which occurs when the child is in a state of apprehension. The viscero-motor reflex is generally present to a marked degree when any of the structures in the abdominal wall are tender, but it is often found without any apparent tenderness. Owing to the peculiar character of the innervation of the abdominal muscles, the contraction usually affects small segments only of the muscular tissue, and the hard contracted areas thus produced are frequently mistaken for tumours of the underlying organs.

The softness of the abdominal wall in children allows enlargement of any of the organs and the presence of tumours, inflammatory swellings, and abscesses to be more easily felt in them than in adults. For the satisfactory palpation of the abdomen, however, in difficult cases, the administration of an anæsthetic may be necessary in order to allow a thorough combined abdominal and rectal examination to be made.

Percussion.—Although not nearly so important in the examination of children as palpation, percussion is also useful in determining the state of the stomach and bowel and the relation of the latter to tumours, and in confirming the results of palpation. It is also of great value in ascertaining the presence of free fluid in the peritoneal cavity.

The Liver.—The lower edge of the liver is usually best made out by palpation. It reaches farther down in children than in adults, and often in health is at least half an inch below the costal margin in the right mammillary line. This is due, partly to the liver being relatively large, and partly to the ribs lying more horizontally than in later life and consequently leaving more of it uncovered (Sahli).

Diminution in the size of the liver-dullness is very rare in childhood. It occurs in acute liver atrophy, in the later stages of cirrhosis, and to a less degree in cœliac disease (Still). Disappearance of the dullness is a valuable sign of the presence of gas in the peritoneum, when gastric or intestinal ulcers have perforated.

Hepatic enlargement is common and may be due to many causes, far the commonest of which is fatty accumulation. It is well to remember that a large fatty liver, though flabby after death, has often a hard sharp edge during life. A large liver

is also found in waxy disease, cirrhosis, passive congestion from heart-failure or from mediastino-pericarditis, and in hepatic neoplasms and cirrhosis.

The Spleen.—Like the liver, the spleen is best investigated in children by palpation. To examine it, one should stand on the child's right side and, laying the right hand with the first two fingers over the left hypochondrium, press gently inwards and upwards. When this is done, its rounded edge will be felt as a soft freely movable body if the organ is enlarged, and also in some cases in which it is normal in size. When beginning to palpate, it is generally well to make sure of the position of the lower costal margin, as the cartilages of the lower ribs are apt to be mistaken for the border of an enlarged spleen. If the child allows free palpation and the spleen is not felt at all, one may generally be sure that it is not enlarged. A large tuberculous spleen may occasionally, however, be beyond the reach of the fingers owing to its being adherent to the under surface of the diaphragm.

Great enlargement of the spleen is often found in children, and may be due to many causes. In those born with active manifestations of congenital syphilis, it is probably always present. In the much commoner cases where the symptoms of that disease only set in after some weeks or months, it may be found before these appear; but often it is rather a late symptom, and it generally persists after the other manifestations have passed off.

In rickets, when the disease is actively progressing, the spleen often enlarges and it may attain a considerable size. It is also enlarged in typhoid fever, in some forms of hepatic cirrhosis, in leucocythæmia, splenic anæmia, waxy disease, and very frequently in tuberculosis.

The Mesenteric Glands.—Enlargement of the mesenteric glands is due in rare instances to tumour formation; and, occasionally, a slight palpable enlargement may be found from non-tuberculous ulceration of the bowel or non-tuberculous peritonitis. In the enormous majority of cases in this country, however, the enlargement is due to tuberculosis, and it is often associated with the formation of palpable caseous masses in the omentum and elsewhere. Tuberculous glands may be present in any part of the abdomen, but they should be examined for specially in the ileo-cæcal region, behind the

umbilicus and below the liver. In some cases they are so deeply situated that they can only be felt when they are very large and hard; and sometimes they can only be discovered by rectal or combined rectal and abdominal examination.

Rectal Exploration.—In abdominal conditions a rectal examination is generally advisable. A simple examination with one finger may be sufficient, as in searching for a rectal polypus; but a bimanual exploration should be made in most forms of abdominal and pelvic disease.[1] It is especially important in cases of obstinate constipation, in spinal disease with possible abscess formation, and in those of tumour and abdominal tuberculosis. The patient, having been anæsthetised, is laid on his back with the thighs fully flexed on the abdomen and a pillow under the pelvis. With the right forefinger in the rectum and the left hand over the front of the abdomen, the right side of the pelvis and abdominal cavity, as far as can be reached, may now be explored satisfactorily. The physician then stands on the child's left side and examines with the left forefinger in the rectum and the right hand palpating in front. In this way, besides feeling enlarged glands or other swellings, he may be able to discover any thickening or matting of the intestine that has been left by former inflammatory attacks.

Hernia.—*Umbilical hernia* is a common condition in infants. It is free from danger, and if treated by the continuous application of a flat pad, held in position by a broad strip of sticking-plaster, usually recovers completely in a few weeks or months. Should it persist, and the opening be large, a small plastic operation may be required for its complete cure.

Inguinal hernia is far commoner in boys than in girls (nine to one); in both sexes it is much more frequently found on the right than on the left side, and it is often bilateral. In slight cases, if the child is carefully nursed and fed so that crying and straining are reduced to a minimum, the hernia often disappears—with or without the use of a truss. The recovery under these circumstances, however, is not always complete; and a small canal is apt to be left, through which the hernia may return in after life as the result of a sudden strain. To prevent the possibility of this occurring and also to save the child from the great discomfort of having

[1] See Geo. Carpenter, "On the Value of Rectal Exploration as an Aid to Diagnosis in Diseases of Children," *Pediatrics*, 1st June 1896, i., 481.

to wear a truss, it is practically always advisable that cases of inguinal hernia should be operated on in infancy. The operation is now almost entirely devoid of danger and is practically always successful. It is well to have it done before teething begins.[1]

Femoral hernia very rarely occurs in childhood.

Rectal Polypi.—When an apparently healthy child repeatedly passes a small amount of pure blood immediately after defæcation, the presence of a rectal polypus should always be suspected.

Rectal polypi are of the nature of adenomata, and they are most frequently situated on the anterior wall, an inch or more from the anal orifice, though they may be found elsewhere. They are generally soft in consistence and rounded in shape; many of them reach the size of a bean or a small cherry. Occasionally they are seen protruding from the anus after defæcation.

The diagnosis is made by feeling round the rectum with the forefinger. Generally there is no difficulty in recognising the polypus; but, if it is very soft, it may readily escape detection.

The treatment consists in seizing the polypus with dressing forceps or with a wire snare, and twisting it off. The cure is immediate and permanent.

Signs of Imperfect or Deranged Digestion.

Disorders of Appetite.

Diminished Appetite (*Anorexia*).—Temporary disinclination for food is shown by most children during the onset of acute disease. Accompanying as it does a lessened power of digestion, it is to be looked upon as a natural and beneficial occurrence. Continued refusal of food, however, is a different matter and always calls for investigation and treatment, especially if it has lasted long and is obviously interfering with the child's nutrition. In delicate children with tuberculous lesions, a small appetite is often a serious evil, because it interferes greatly with the fattening process which is so much to be desired in them.

[1] H. J. Stiles, "On the Operative Treatment of Hernia in Infants," *Brit. Med. Journ.*, 1904, ii., 813.

The normal inclination for food may be interfered with in various ways.

1. In a few cases it is caused by a painful condition in the mouth or throat, such as stomatitis, dental caries, or pharyngitis, and will pass off when these are attended to.

2. Confinement to the house and lack of exercise are even commoner causes in children than in adults; and, whatever the loss of appetite is caused by, a change of air and surroundings will often work wonders.

3. In many cases the disinclination to eat is due to anæmia or debility. In the former, a grain or two of citrate of iron and quinine, and in the latter, dilute hydrochloric acid (1 to 3 minims) or bicarbonate of soda (3 to 5 grs.) with tincture of nux vomica (2 to 4 minims) thrice daily, well diluted, before meals, will generally be found useful.

4. The appetite is often discouraged by the child being given food too frequently, because he takes so little each time. When this is done, the stomach has no time to empty itself before it is called upon to deal with a fresh supply of food; and a lengthening of the intervals causes a marked improvement.

5. Distaste for food commonly accompanies constipation, and tends to disappear when the bowels can be got to act regularly and freely.

6. Loss of appetite is one of the common symptoms of chronic intestinal indigestion, which is generally greatly improved by suitable changes in the diet (p. 257). In these cases, also, the internal use of ichthyol (1 to 2 grs. t.i.d.) has often a strikingly beneficial effect.

7. In many, probably in most, cases of refusal of food in young children the defect lies mainly, if not altogether, in the child's mental condition, and the only efficient treatment consists in a careful and judicious training of his habits of life, such as he has probably not had before.[1]

We find that in the past he has been unwisely accustomed to expect almost everything to be done for him, but that he has early learned that one thing that he can always do without trouble to himself is to refuse the food that is offered to him. He has found that his doing so gives rise to a pleasant sense of importance and power on his part, and a gratifying

[1] See interesting account of this condition in *The Nervous Child* by H. C. Cameron, London, 1919, 50.

amount of disturbance on that of his mother and nurse. This habit of refusing food increases greatly at times when he is out of sorts or out of temper, and every meal becomes a struggle between him and his seniors. Their great anxiety on the subject magnifies its importance in his eyes; and the various devices they employ to make him eat—such as telling him stories during meals, persuading him to take a spoonful for each member of the household, etc., etc., have only a very temporary effect. The act of eating gets less and less spontaneous, and ultimately he becomes convinced that he cannot possibly swallow the food, and each attempt to make him do so ends in vomiting. Whenever a child shows any tendency to this sort of conduct, trouble should be taken to increase his initiative; and his natural tendency to imitate his elders should be fostered in every way. He should be made to do everything possible for himself, and be waited on only when it is quite necessary to do so. It is in children who are used to being fed, and not in those who have been encouraged to show their cleverness by feeding themselves like grown-up people, that such difficulties arise.

The attitude of the mother and nurse to the subject is the important matter. As already indicated, anxiety and fussiness on their part are fatal, while a confident, unemotional, off-hand manner will often work wonders. It is also important that, in the intervals between meals, the child's refusal of food should never be alluded to in his presence. Any mention of it constitutes a pernicious suggestion which is sure to favour its recurrence. The least hint given that he is not expected to eat well makes it more difficult for him to acknowledge his past error by giving up his bad habit. When he shows the slightest improvement, however, it may do good to emphasise this by showing him that it is taken for granted that, now, he has no longer the difficulty he used to have and that all concern about the matter is at an end.

Cases of this kind may take a long time and give a great deal of trouble; but, if those in charge are sensible, and have the nature of the trouble clearly explained to them, they will often show a natural skill in "mother-craft" that soon puts things right.

Increased Appetite (*Bulimia*).—An excessive desire for food is sometimes a sign of indigestion; occasionally it is

merely the result of a bad habit; in diabetes, it is not usually such a prominent symptom in children as in adults.

Depraved Appetite (*Pica*).—In some otherwise normal children—as well as in many who are neurotic or mentally deficient, there is at times an unnatural craving for earth, coals, lime, or other things unfit for food. This is apt to be aggravated when anæmia, intestinal indigestion, or worms are present (see Pica, p. 573).

Gastric Flatulence.—In older children, as in infants, wind in the stomach is often due to air-swallowing, though it is usually attributed to fermentation of food from indigestion. When the wind is swallowed, it rarely gives rise to much discomfort so long as the child is going about, as it is usually brought up again. When children, however, are kept lying on their back for any reason, as for spinal caries, the abdominal distension caused by air-swallowing is apt to become distressing, and in weakly ones even dangerous. Under these circumstances, the patient has to be raised from time to time to a vertical position to allow spontaneous eructation to take place.

If the flatulence is due to fermentation, its treatment is mainly prophylactic, and consists in the regulation of the quantity and digestibility of the food and of the way in which it is taken. Pepsin with acid or a carminative, and papain with an alkali are sometimes useful.

Intestinal Flatulence.—When an indigestible excess of starch, milk-curd, vegetables, or fruit is taken, the normal amount of wind in the bowel is greatly increased. By lessening these elements in the diet the formation of excessive flatulence can usually be stopped at once.

Intestinal Colic.—Ordinary colic is due to violent peristaltic contractions of the small intestine, and the pain is always referred to the middle line in the region of the umbilicus. It is set up, in older children, by the same causes as in infancy (p. 126), is recognised by the same characters, and relieved by the same treatment.

Vomiting and Diarrhœa.—The causes of vomiting and diarrhœa have already been considered.

Constipation.—The causes and treatment of constipation in infancy have also been already described (p. 128). A few points may now be dealt with regarding the condition as it appears in older children. When a child is brought to us with this com-

plaint, it is well to begin by enquiring as to its duration—whether it is of long standing or only a recent development—and, if recent, as to the circumstances under which it has arisen.

If the constipation is of long standing it may, in rare instances, be due to anal stenosis, megalocolon, or some other anatomical peculiarity. In the large majority of cases, however, it is due to defective training, to habitual injudicious diet, or to general bodily and mental atony.

If it has lasted only a short time, we must enquire as to recent bowel disorder (*e.g.* colitis), and be on the look-out for indications of the presence of a rectal fissure (p. 114). This latter condition is not very rare, and it is important that, if present, it should not be overlooked, because of the special treatment it requires. In older children, especially in girls, severe constipation sometimes comes on as a hysterical symptom along with mental depression.

Habit.—The formation of a habit of having the bowels moved regularly is a most important point in the treatment of most cases of constipation; and our other methods of treatment should all be used mainly with the view of establishing such a habit. It is always desirable to see to it, not only that the child gets into the way of going to the closet regularly after breakfast, but also that his other morning duties are so arranged that he shall not be hurried unduly in the performance of this important one. The normal habit of having the bowels emptied regularly is often interfered with greatly by the same mental attitude of "negativism" which, as we have seen, causes refusal to take food (p. 248), and this has to be treated on the lines indicated for that condition.

Diet.—Constipation in children, as in adults, may be due to the food given being too completely digestible. Quite as often, however, it is caused by an excess of incompletely digestible substances such as oatmeal porridge, brown bread, raw fruit, and vegetables which are being given him with the idea that they are necessarily laxative. In many cases these things fail altogether to stimulate the bowels as they are expected to do, and then they set up chronic intestinal indigestion with large undigested motions which are difficult to get rid of. In such cases, a complete change of food—malted cereals, "malted milk," fruit juice, jellies, meat, eggs, and soups—is usually followed promptly by regular motions. A diet containing too much

white bread, farinaceous puddings, and undiluted milk is also, of course, objectionably constipating.

Mechanical Aids.—At the beginning of the treatment in a bad case, glycerine suppositories or injections, or small soap and water enemata, may be useful in helping to form a regular habit, but these measures should only be used temporarily. If they are continued for long, the child gets into the way of trusting to the artificial stimulus they supply, and his constipated tendency remains.

Massage.—Along with the regulation of diet the use of skilled massage may be of great value in establishing regular ways. In hysterical cases, a course of Weir Mitchell treatment has often in my experience been most successful.

Medicines.—As already said, drugs are mainly to be used to initiate and foster regular habits. Cascara with malt extract or rhubarb (Appendix I, Form. 18), infusion of senna pods, other preparations of senna such as "Fig Syrup," various fruit pastes which chemists prepare, and heavy magnesia or phosphate of soda (q. s. with all meals) are all sometimes useful. So also are "Regulin" (agar-agar) and phenolphthalein; and a course of a purgative mineral water or of Carlsbad salts may sometimes prove beneficial. In all cases, the careful regulation of the dose necessary is important; and it should be gradually lessened as good habits become established.

Incontinence of Fæces.—Habitual involuntary passage of the motions may be due to paralysis of the sphincter in such conditions as Pott's disease and spina bifida. It often comes on temporarily from mere weakness in children exhausted by diarrhœa and other debilitating conditions; and in nervous children when indisposed, as during the onset of an acute illness. In such cases, no local or special treatment is called for.

A different type of case sometimes occurs, apparently as the result of inco-ordination similar to that in enuresis. It is indeed often associated with that symptom, and is much more frequently diurnal than nocturnal. This kind of incontinence is seen in nervous anæmic children, and in those who are stupid and ill-regulated and show some degree of mental instability. The motions, though they may not be too numerous, are often unhealthy. This condition is common in the mentally deficient.

Treatment.—(1) If debility is present, means should be taken to improve the general health by tonics such as iron, arsenic, and strychnine, and by the administration of cold douches. (2) The digestion must be attended to, and if the motions are unhealthy or there are other reasons for suspecting the presence of intestinal indigestion, it will be well to limit the amount of starchy food taken and to stop uncooked fruit and the coarser vegetables for a time. (3) Ergot and belladonna are sometimes of use, as in incontinence of urine, and Still recommends a course of Dover's powder (1 to 3 grs.) thrice daily. (4) At the beginning of the treatment it sometimes helps in restoring the child's confidence in himself if the bowel is emptied every morning for a time by an enema. (5) Very frequently, the psychical part of the treatment is the most important. The bad habit is, for example, checked at once in many cases by the mental effect of removal to a hospital ward. Henoch recommended the subcutaneous injection of ergotin (1 gr.); he suspected, however, that the good effect of this was largely due to its painfulness.

CHAPTER XIII

ON SOME DISEASES OF THE DIGESTIVE SYSTEM

Chronic Intestinal Indigestion.

CHRONIC intestinal indigestion is the name which is now usually given to a very common form of dyspepsia, the main feature of which is an inability to digest and absorb with comfort an ordinary amount of certain common articles of diet—especially vegetable and starchy foods. It is present to some extent in a large proportion of delicate children. In slight cases the symptoms may be so trivial as to escape notice, the child being brought merely because he is not gaining weight or seems out of sorts. In severe cases, however, they may be distressing, and occasionally may simulate closely those of grave organic disease. From the point of view of general practice, there are few maladies of early life more important than chronic intestinal indigestion, because it is so commonly met with, causes so much worry and anxiety, and yet is so amenable to proper treatment. It is found in all ranks of society, and is especially frequent and severe in the children of gouty and neurotic parents. It often appears between the third and fifth year, but is more common in older children, and it generally ceases to occur long before adolescence.

Symptoms. — These may be divided into three groups: (1) there are indications that something is interfering with the child's growth and nutrition; (2) there are various signs that the digestive organs are out of sorts; and (3) there are derangements of the nervous and other systems, obviously due to auto-intoxication.

(1) The patient is generally thin and delicate-looking; he is often slightly built and looks young for his years. He is

usually pale-faced, although his mucous membranes may show no definite sign of anæmia. The skin is soft and normal in most cases. The limbs are slender and feeble, and all the muscles poorly developed. The hands and feet are apt to be cold and flabby. Not infrequently there are symptoms of the presence of adenoids.

(2) On investigating the state of the alimentary tract, we find various more or less indefinite signs of derangement. The tongue may be fairly clean, but usually it is covered with a slight brownish fur and has a peculiar slimy appearance. In bad cases the breath may be offensive, but often this is not so; there is frequently a short dry cough—a "stomach cough." The abdomen may be more or less distended, although nothing further can be made out on palpation. The bowels are generally constipated, the motions being pale and pasty, sometimes clay-coloured, and sometimes very offensive. Sometimes there is chronic diarrhœa with large foul-smelling stools, and occasionally lienteric attacks occur. On examination of the motions, an abnormal amount of mucus is usually found; and, when this is not apparent on naked-eye examination, it may often be revealed by the microscope. At times the motions seem quite normal. Thread-worms are not uncommonly present. The appetite may be poor, excessive, or fairly normal. Sometimes there is a history of recurrent abdominal pains of a colicky nature, and sometimes frequent attacks of acute indigestion.

(3) The last group of symptoms are those which are due to recurrent intestinal auto-intoxication. The child is not only pale and thin, but often looks wearied and miserable and has dark rings round his eyes. Many of the older children complain of headache. Although in many cases the patients are bright and intelligent, they easily get tired and irritable. Sudden attacks of pallor and faintness are not uncommon, and these are apt to be attributed by the patient's friends to heart-disease. In young children convulsions may even occur. Rarely, we meet with a degree of drowsiness, irregularity of the pulse, and vomiting, that are suggestive of tuberculous meningitis. Sleep is often restless and disturbed; night-terrors are common and, in older children, somnambulism. Grinding of the teeth and picking of the nose are often noticed, quite apart from the presence of intestinal worms. Many of

the patients have enuresis. A very frequent and characteristic symptom is profuse perspiration; and in a few of the cases there may be a slight evening rise of temperature which may go on for weeks. The urine is generally high coloured and strong smelling and shows a decided indican reaction. Sometimes a trace of albumin is present, and occasionally coli-bacilluria.

Diagnosis.—There is no class of cases more often misunderstood and wrongly treated by young practitioners—various mistakes are made. Sometimes the children are supposed to be in a general way "tuberculous," and cod-liver oil is therefore given to them till they are sickened by it and put altogether off their food; or the diagnosis is "debility," and prolonged courses of iron tonics are administered with a somewhat similar result. Often, because the children are thin, an extra supply of "milk puddings" and other farinaceous foods is ordered to fatten them; or, on account of their constipation, they are given large quantities of porridge and fruit.

Although cases of chronic intestinal indigestion are often erroneously diagnosed as tuberculosis, it must be remembered that many tuberculous children suffer also from this form of dyspepsia. When this is so, the treatment of the digestive disorder is important in addition to the open-air regimen. Fortunately, the effect of the increased exposure to fresh air has a most beneficial effect on the defective digestion as well as on the tuberculosis.

Prognosis.—In considering the prospects of a speedy recovery we must take into account the degree of injudiciousness with which the child has hitherto been fed, and the extent to which the mother can, and will, carry out instructions. If the feeding has been on quite wrong lines and is at once altered according to directions, the result is in most cases strikingly successful; the patient rapidly improves and becomes "quite a different child," as the mother says. If the former dieting, however, has been fairly judicious, the improvement may be relatively slow. If the reform in diet is carried out intermittently and in a half-hearted fashion, its effect is almost sure to be disappointing.

Treatment. — In starting the treatment of the case, the parents should be warned that it must be carried out strictly for some weeks at least, to begin with. When this preliminary

period is past, there is usually no difficulty in persuading them to continue the diet, in spite of the trouble it causes, because the results are so satisfactory. The parents must also be made to realise that the matter is in their hands, and that the medical man can only advise them as to the various details—dietetic, medicinal, and hygienic—by attention to which they are themselves to cure the child.

Dietetic Rules.—The exact details of the diet to be ordered in any given case must vary with the child's age and social circumstances, and also with the stage of the malady and its degree.

The chief points to remember are, *first*, that the child's ability to digest starchy food of all sorts, and sugar, is much less than that of normal children; and that, if too much of these foods is given, more or less severe auto-intoxication and discomfort will follow, often without any ordinary dyspeptic symptoms. *Secondly*, the usual incompletely digestible elements of the diet such as are found largely in fruits, vegetables, oatmeal, brown bread, milk-curd, and certain fatty foods, may greatly aggravate the child's condition and reflexly set up unpleasant nervous symptoms. In ordinarily healthy children a great excess of any of these foods produces somewhat similar symptoms, but in these patients the morbid phenomena occur after very moderate amounts.

In framing a diet, the mother's experience of what the child has in the past been able to digest with comfort should always be taken into account. The directions given should always be written out; for, if this is not done, some of them are very likely to be forgotten and undesirable variations substituted for them.

The table on p. 258, while it indicates the general lines to be taken in these cases, must, of course, be varied in individual instances.

The child should not be pressed to eat more than he is inclined for, and four small meals are better for him than three larger ones. Indeed, moderation, even in the food that seems to agree best, is always important, and he should never be allowed to take a very large amount of anything. He must also be encouraged to chew his food properly, and, with this in view, special attention should be given to the state of the teeth.

May not be Taken.	May be Taken.
Ordinary bread, biscuits, porridge.	Bread (baked hard in the oven), rusks.
Farinaceous puddings (sago, rice, tapioca, arrowroot, cornflour, etc.).	Malted foods ("Veda Bread," "Grape Nuts," "Force," etc.).
Pastry, cheese, sweets of any kind.	Any of the malted "Infants' Foods," calf's-foot jelly, lemon sponge.
Much butter, any jam.	A little butter or jelly.
Thick or vegetable soups.	Clear soup, beef-tea, chicken-tea.
Fried or salt meats.	Underdone meat, chicken, rabbit, fish, tripe, eggs (usually).
Vegetables (except as opposite).	A little cauliflour or spinach, or a *little* mashed potato.
Fruit.	Fruit juice.
Plain milk.	Modified milk, whey, buttermilk, and milk with potash or lime water.
Cocoa, tea, and coffee.	Milk prepared with peptogenic milk powder (with half the usual amount of cream), malted milk, or condensed or dried milk.

Even when the special diet is suiting him very well, it is important not to restrict the child's food too long, or too severely, because it is good for his digestion to be gradually trained to deal with those foods which give him some difficulty.

Medical Treatment. — The medicines which are usually prescribed consist of alkalies, tonics, malt preparations, the so-called "intestinal antiseptics," and laxatives. Soda with rhubarb or nux vomica (Appendix I, Form. 19) is generally found useful; and, if there is much anæmia, iron may be cautiously tried—ferrum redactum or a laxative iron mixture (Appendix I, Form. 8); cod-liver oil is rarely well borne. Such "intestinal antiseptics" as salol are often given because of the offensive motions, but they are of little benefit; an occasional dose of calomel generally does good. A very useful drug, in my experience, is ichthyol, which may be given in doses of 1 to 3 grs. in capsules, or to younger children in solution (Appendix I, Form. 20). It is rare for children to object to its somewhat nauseous taste. Extract of malt does not usually agree well, though its laxative properties may be useful. Taka-diastase is frequently beneficial.

When constipation is present, liquid paraffin, cascara, compound liquorice powder, compound decoction of aloes,

or Carlsbad salts may be tried. Abdominal massage and exercises to strengthen the abdominal muscles are helpful in many cases.

Hygienic Treatment.—Careful attention must be given to the child's clothing, as recurrent chills—for example, from bare legs and arms—are apt to aggravate the symptoms. A cold douche, with suitable precautions, is usually good for these children; and widely open windows and interesting open-air exercise are always important. Over-exertion of any kind, however, is to be avoided, and emotional excitement, worry, and want of interest are all harmful. In the case of the younger and more nervous patients, a midday rest in a darkened room is a great advantage, even if the child does not sleep.

Complete change of air and scene do probably more good than any other single measure besides the diet. Many of these children, who are chronic invalids at home during school time, lose all their symptoms during the summer holiday, without any other special treatment. With some of them the seaside agrees very well, but hill air is preferable in most cases. The striking benefit derived from a country life is doubtless due in part to the increased amount of fresh air, but there can be little question that the change of scene and occupation and the mental stimulus of new experiences have also a great deal to do with it.

The Cœliac Disease

(*Intestinal Infantilism*).

The name "Cœliac Disease" was given in 1888 by Dr Gee[1] to an interesting and important, though not very common, group of cases, the main features of which consist in obstinate recurrent diarrhœa lasting for years, a remarkable arrest of growth with infantilism, pallor, muscular debility, and abdominal distension. The condition is now recognised as a clinical entity, and has been investigated and described under various names by a number of observers.[2] The accuracy of Gee's

[1] *St Bart. Hosp. Rep.*, xxiv., 1888, 17.

[2] W. B. Cheadle, "On Acholia," *Lancet*, 30th May 1903, i., 1497; C. A. Herter, *Infantilism from Chronic Intestinal Infection*, New York, 1908; R. A. Gibbon's "The Cœliac Affection in Children," *Edin. Med. Journ.*, Oct. and Nov. 1889, 291 and 420.

original description of the disease has been fully confirmed; but, so far, little has been added to our knowledge of its pathology, and its causation remains quite obscure. G. F. Still has recently given an excellent account of all that is known about it in his Lumleian Lectures,[1] to which and to Herter's monograph, the following account is largely indebted.

Clinical Features.—The cœliac disease is not due to poverty or to unhygienic conditions, for it occurs oftener in private than in hospital practice. It is three or four times as common in girls as in boys, and the patients are usually, if not always, bottle-fed.

In most cases, the earliest symptoms appear in later infancy—between nine months and two years. They may begin with an acute attack of diarrhœa, but in some cases there is constipation at first, in a few vomiting, and in others simple wasting. Sometimes the patients have formerly been healthy, sometimes they have suffered from digestive disturbances and, not infrequently, there is a history of infantile scurvy.

Symptoms.—After the disease has gone on for a year or two, the child's appearance is very characteristic. He is pale and listless and, though his cheeks may still be round, his limbs are thin and flabby, and he is very easily tired and shows a strong and increasing disinclination to go upstairs. In one of Still's cases, this flaccidity of the muscles was so extreme that the patient did not walk till he was six and a quarter years old; and in most cases the children are unable to run or jump for a long time after the intestinal symptoms have been recovered from.

If the disease has lasted long, the small size and infantile proportions of the patient are very striking; he looks several years younger than he really is, and he seems always tired. On X-ray examination it is found that the stage of ossification in the limbs is that of the apparent, and not that of the real age. The mental development, though not defective in the usual sense, is often rather infantile like that of the child's body; though his invalid life may have made him prematurely thoughtful and introspective beyond his years. He is, at times, touchy and irritable; and any excitement or special mental effort is apt to be followed by obvious fatigue and depression.

[1] *Lancet*, 10th 17th, and 24th Aug., 1918, ii., 163, 193, and 227.

The voice is often high-pitched and squeaky, probably from the larynx being abnormally small. There are usually no symptoms of rickets. The temperature-curve is normal, though it is sometimes a degree or so higher than usual. There is nothing characteristic in the state of the blood or urine.

The abdomen is more or less enlarged and feels doughy on palpation. This often leads to a mistaken diagnosis of abdominal tuberculosis. The liver is very rarely enlarged, and it almost always seems unusually small. Abdominal pain is rare, except in the later stages of the disease, and vomiting seldom occurs.

The condition of the stools is almost pathognomonic. There are usually only two or three motions in the day, but they are very large and pultaceous, having the consistence and colour of porridge, and a lustrous, greasy appearance from the excess of fatty matter which they contain; they are never formed. They have a sour and rancid odour and are peculiarly offensive. A temporary improvement in their colour and consistence occurs from time to time, and occasionally they may for a short time look almost normal. Every few weeks there is an exacerbation, during which the motions become rather more frequent (three or four) and loose. The weight often remains stationary for months or years. Other symptoms, such as sweating on the head, coldness and clamminess of the extremities, and excessive, or capricious appetite often occur.

In the later stages of the disease—after two years or so—the characteristic porridgy appearance of the motions is less noticeable and they become shreddy and soft, with a pale grey, greenish, or even a dark brown colour, and show an excess of mucus and sometimes a little blood or pus. These changes seem to indicate secondary inflammation in the bowel.

Complications.—As in other forms of severe long-continued diarrhœa, œdema and purpuric eruptions are not uncommon. Tetany occurred in three of Dr Still's cases and scurvy in five. The scurvy is doubtless often due to the severe restriction of the diet, but in some cases it has begun before the bowel-symptoms.

Prognosis.—The disease rarely lasts less than one or two years and often goes on much longer (three to eight). After the first two months, the patient settles down to an invalid

existence, periods of slight improvement being succeeded by frequent relapses. Later, in those cases which do well, the stages of improvement become more definite and last longer, and the relapses are fewer and less serious; weight is gained, an ounce or two at a time; and, finally, the appetite improves and the motions become more constantly normal, in spite of the diet being more ordinary. Relapses are common and sometimes serious, and they may end fatally. Complete recovery of health takes place in a considerable majority of those cases which are carefully and continuously treated, but probably only in a small minority of those in which the diet is not properly regulated and too much reliance is placed on drugs. In my experience, however, as in Dr Still's, the patients in the long protracted cases have always remained subnormal in stature. Death may occur from a severe relapse of the diarrhœa, or it may be due to intercurrent disease.

Morbid Anatomy.—Very little that is distinctive has been found *post-mortem*, apart from thickening of the alimentary mucous membrane, with small-cell infiltration and intra-lobular pancreatitis, which may quite probably be secondary.

Causation.—Although the pathological appearances suggest the probability of a micro-organismal origin for the disease, little that is definite has been established to favour this idea. According to Herter the disease is characterised by an abnormal predominance in the bowel of some types of organism (B. bifidus, B. infantilis, and certain cocci) which are normally present in early infancy but not at the age of these patients; and at the same time by a complete or almost complete absence of B. coli and B. lactis ærogenes—the organisms which ought to predominate at this age. He regards the imperfect absorption of food-stuffs, to which the retardation of growth is apparently due, as depending on a chronic inflammation of the ileum and colon caused by the presence of the unusual and the absence of the usual bacteria. His opinion on this matter, however, has not been generally accepted or confirmed by other observers. In six out of eleven of Still's cases which were investigated bacteriologically, the dysentery bacillus was present; and he is of opinion that "there is clearly a strong probability that in some of the cases of cœliac disease, if not in all, there is a primary infective catarrh of the bowel, and that this is due, in some at least, to the dysentery bacillus."

Dr R. M'Carrison has recently suggested[1] that the causation of cœliac disease may be connected, to some extent, with deficiency of vitamines in the diet, as he has found similar symptoms occurring in pigeons fed exclusively on autoclaved, milled rice.

Treatment.—*Diet.*—Success in the treatment of cœliac disease depends very little on medicines; and we have to rely almost entirely on extreme care and discretion in managing the details of the diet and hygiene, and suiting them to the idiosyncrasies of the individual child. There are very few diseases, indeed, which try the patience and perseverance of all concerned so severely. Our great aim is, of course, to improve the patient's nutrition, and especially to increase the defective fat-assimilation as far as is possible. This we endeavour to do by giving the necessary amount of fat only in such forms as the child has been found able to digest. Another indication which must be borne in mind is the lessening of unabsorbed decomposing fat in the bowel. To this end we must reduce the amount of fat in the food as far as we can without dangerously reducing its nutrient value.

In considering in what respects the diet is to be restricted, we find that most of the common foods that agree with healthy children have to be forbidden. Fresh cows' milk must be greatly lessened, or if possible stopped altogether, for it is always found to disagree badly in these cases. Formerly its disagreeing was explained on the theory that the children could not digest its curd; but this is not the main thing, and we find that it is not rendered more digestible to them when it is peptonised. It is now believed that it is the quantity and character of the cream in it that makes the cows' milk disagree. Far the best substitute for it is human milk. This, is of course, usually impossible to arrange for; but in two serious cases of cœliac disease, Still obtained far better results from it than from anything else. The next best substitute is fresh asses' milk, with its small percentage of cream as well as of easily digested proteid (p. 157). Its cream is found to be much better absorbed than an equal amount of cream from cows' milk similarly diluted. When neither human or asses' milk can be obtained,

[1] "Pathogenesis of Deficiency Disease," *Indian Journ. Med. Research*, 1919, vi., 3, 275-355, and vi., 4, 1826-1827; also abstract in *Brit. Med. Journ.*, 12th July 1919, ii., 39.

one of the varieties of dried cows' milk with a low percentage of cream should be used, such as the "Cow and Gate Half-cream Brand." In some children, also, kumyss is well borne. In the few cases in which cod-liver oil can be taken it is very beneficial, and Holt has published a case in which it had a remarkable effect on the retarded growth.[1]

In the rare instances in which eggs are found to agree, they form a very useful addition to the diet; but generally it is only the white that can be digested. Meat, chicken, and fish—pounded or prepared in any other way—rarely agree except in small quantities, and they are only of use after the symptoms have begun to improve. Chicken and veal broth are sometimes taken well, and meat jellies and preparations of gelatine sweetened with saccharine, usually agree, and form, so far as they go, a useful addition to the diet (Herter). The scorbutic nature of this diet suggests the desirability of giving fruit juice. Unfortunately, however, this is only occasionally found to agree; and vegetables also are generally badly borne, although a small amount of mashed potato sometimes agrees fairly well.

Special attention must be given to the carbohydrates in the diet as they are responsible for many of the digestive disturbances. Sweets are quite inadmissible and so is bread and butter; indeed very few of the patients can stand any ordinary bread at all. Rusks and baked bread are rather better; and such malted foods as "Force," "Grape-nuts," "Allenbury's Diet," "Benger's Food," "Mellin's Food," and "Mellin's Biscuits," should be carefully tried; though malt extract always disagrees and causes flatulence and diarrhœa. "Revalenta" can often be taken in small quantities. Among the best forms of starch are rice which has been boiled for three or four hours, and arrowroot.

In dieting these children it is important that only one new form of food should be tried at a time; and also that no form of food, though it seems to agree, should be given in large quantities.

Inunction of oil has often been suggested as a means of increasing the intake of fat, but there seems to be no proof of its ever having done any good.

Medicines.—Neither pancreatic extract, ox-gall, nor thyroid has been found useful, and the last named is apt to cause

[1] Holt, Courtney, and Fales, *Amer. Journ. Dis. Child.*, Sept. 1917, xiv., 2, 222.

nervousness and loss of weight. Calomel and grey powder have not the good effect so often seen from them in other kinds of diarrhœa. Small doses of brandy are beneficial in some cases. The most generally useful medicine in cœliac disease is castor-oil. If a purgative is indicated it is the best to use; but, apart altogether from this action, its regular administration, in 5-minim doses thrice daily, is very often followed by a distinct improvement in the appearance of the motions and in the other symptoms. It may be given in emulsion (Appendix I., Form. 20); Still recommends the addition of 2 or 3 grs. of salol to each dose. Another drug which sometimes does good is nitrate of silver, in doses of $\frac{1}{6}$ to $\frac{1}{4}$ gr. thrice daily. Bismuth is often given, but seldom seems to improve matters. The foul character of the stools suggests the trial of intestinal antiseptics; but their action has proved disappointing. Calomel and grey powder often disagree; and, though salol may not do so, I have never seen any definite improvement follow its administration.

Hygienic Treatment.—While carefully and continuously regulating the diet, we have to attend to the hygienic conditions and do all we can to shield the patient from exhaustion and from anything that might favour complications. Warm clothing is necessary, with open air short of chilling, if possible in a sunny equable climate. While the symptoms are progressing, the child should not be bothered with lessons, but congenial occupations and regular exercise, which must always stop short of fatigue, are indicated. Herter emphasises the value of soothing human surroundings and companionship. From what has been said, it is easily seen that the means at our disposal at present for the treatment of this disease are far from being quite satisfactory; but yet, as Dr Still says, "it is nearly always possible to obtain marked improvement in these cases, and a large proportion of them can be coaxed back, after many months or years of patient perseverance, with a very restricted diet, to health and even to an average power of assimilation."

Lienteric Diarrhœa.

Lienteric diarrhœa is an ailment which should always be borne in mind when colic and loose motions occur in an otherwise healthy child. When the case is recognised to be of this

nature it can almost always be quickly cured by appropriate treatment; while if it is mistaken for one of the ordinary forms of dyspeptic diarrhœa, as often happens, it may last a long time and give a great deal of trouble.

Clinical Features—The cardinal symptoms of the malady are three in number—sudden discomfort, griping pains, and an urgent desire to empty the bowel. These set in during, or immediately after, the taking of food, and often the child has to rise hurriedly from the table when he has scarcely begun his meal. The motions consist of half-digested food with much mucus. In a few cases the discomfort and pains occur without diarrhœa following. When the motions are large the child gets pale, weak, and nervous from loss of nourishment; but in other respects he usually seems fairly well.

Lienteric diarrhœa is most commonly met with in children between five and eight, but it may occur at any age. It is important to remember, also, that the condition is occasionally met with in quite young babies. In them, owing to the frequency of the feeding, the relation of the diarrhœa to the taking of food is apt to be overlooked.

Treatment.—The symptoms are not usually influenced at all by restriction of the diet, and astringent diarrhœa mixtures have no effect on them. They are brought to an end at once, however, by small doses of liquor arsenicalis. In older children the dose is one drop, which should be given with a few drops of tincture of cardamoms in a teaspoonful of water immediately before each meal. In babies, half or even a quarter of a drop, before each bottle, is usually enough. If the case is obstinate, 2 or 3 grs. of Dover's powder may be given to older children; but generally, the arsenic is entirely successful.

Intestinal Worms.

The chief intestinal parasites met with in children in this country are thread-worms, round-worms, and tapeworms. Thread-worms are much the commonest variety; tapeworms are rare in children under four years.

The presence of worms can only be recognised with certainty by finding either the parasites or their ova in the stools. In doubtful cases eosinophilia should be looked for. The treat-

ment of any sort of intestinal worms requires close attention to details and sometimes great perseverance.

Thread-worms (*Oxyuris Vermicularis*).—Thread-worms live mostly in the cæcum and appendix; but they are also found in other parts of the colon, in the rectum, and, less frequently, in the small intestine. The ova are taken in by the child along with his food; and they are apt to be constantly reintroduced by his fingers, which become contaminated owing to his scratching the neighbourhood of the anus.

The general symptoms are mainly those of chronic intestinal catarrh, but sometimes nervous symptoms such as convulsions are also met with. Local symptoms of various kinds, due to the irritation of the worms, may also be present. Among these are severe itching about the anus, mucous diarrhœa, tenesmus, prolapse, frequent micturition, retention of urine, priapism, and vulvar discharge. The nostrils, also, are sometimes red, itchy, and sore from the child's picking his nose with fingers soiled with the irritating substance of the thread-worms.

Treatment.—To be successful, the treatment must aim not only at expelling the parasites, but also at preventing reinfection and improving the state of the bowel.

Expulsion of the Worms.—To drive the worms down into the lower part of the bowel, a dose of castor-oil, or of calomel and santonin (āā 1 gr.), is first given. When this has acted, the colon should be cleared by a large soap and water injection. It is well to use a vermicide enema after this, and to repeat it every alternate morning for a week. For this purpose, a solution of common salt (a teaspoonful to 5 oz.) or infusion of quassia (5 to 7 oz.) may be given after the bowels have acted. The fluid is to be introduced slowly and allowed to stay in as long as possible.

Prevention of Reinfection.—This is most important, and it is often forgotten. The anal region must be carefully washed after each motion, and it should be smeared with ung. hydrarg. The child's nails should be kept very short, and they must be frequently brushed with carbolic soap. Any uncooked vegetable food that he takes must be carefully washed.

Improvement of the General Health and of the Digestion.—Both general debility and indigestion strongly favour the continuance of the worms. The treatment is therefore not complete until the general health and digestion have been

attended to. Iron or bitter tonics may be required, and the diet may have to be regulated on the lines recommended for chronic intestinal dyspepsia (p. 257).

Round-worms (*Ascaris Lumbricoides*).—These live mostly in the small intestine, but wander at times into other parts of the alimentary canal. The ova are swallowed in impure water.

The symptoms are usually indistinguishable from those of dyspepsia. Sometimes nocturnal diarrhœa occurs. Convulsions, sudden rises of temperature, and other nervous symptoms are not uncommon.

Treatment.—This consists in the administration of santonin, alone or combined with calomel (āā 1 gr.). The powders may be given every night for three nights, and should be followed in the morning by a dose of senna or salts.

Tapeworms.—The *Tænia mediocanellata* or beef tapeworm is much the commonest species in Britain; though the *T. solium*, acquired from pork, is sometimes found. While these species are too well known to require description here, attention may be specially called to the *T. cucumerina* which is occasionally found in young children who are in the habit of playing with dogs. This tapeworm is small and short (6 to 12 inches), and its proglottides are long and narrow and have bilateral genital pores; they are mostly separate when passed, and look like rather large flat grains of boiled rice. The larval form develops in the louse of the dog, and is carried to the child's hands or to his food by the animal's tongue.

Treatment.—There is sometimes very great difficulty in getting rid of tapeworms in children; and even when the details of treatment are carefully attended to, the head is apt to be left in the bowel. The following are the measures which I have found most successful, in obstinate cases. (1) A number of small capsules containing extract of male-fern should be prepared, and also similar capsules containing treacle. For a week or two the child should be trained daily to swallow the treacle capsules till he can do so quite quickly and easily.

(2) He should then be put to bed for two days and given only such articles of diet as will lessen the intestinal contents and the secretion of mucus in the bowel—soups, jellies, eggs, Benger's and Mellin's Foods. He should have no milk and no farinaceous food.

(3) During these days his bowels should be kept moving by a daily dose of citrate of magnesia or some other mild laxative.

(4) On the second night, a dose of castor-oil should be given and no food after it until the worm has been passed.

(5) On the third morning he should have, at intervals of an hour, three doses of the male-fern capsules, each equivalent to 30 minims.

(6) Three hours after the third dose of capsules, castor-oil should again be given. Capsules sufficient for four doses should be prepared in case some of those given should be vomited.

Trichocephalus Dispar.—The whip-worm is often found post-mortem in the intestine in children, and, during life, the ova are not uncommon in the stools. It produces no symptoms, and no drug seems to have any decided effect upon it.

Acute Intussusception.

This is a most important, as well as characteristic, disease of infancy, as it accounts for fully three-fourths of the cases of acute obstruction of the bowels in young children. It occurs frequently in breast-fed babies and is commonest between four and eight months; a considerable majority of the patients are under one year. Older cases, however, are not uncommonly met with.

Symptoms.—The onset of the disease is almost always quite sudden; although, in some cases, the acute symptoms are preceded by a few days of gastro-intestinal derangement. Occasionally there is a history of a sudden fall or other forcible movement of the body having occurred just before the child took ill.

The main symptoms are three in number: (*a*) abdominal pain; (*b*) vomiting; and (*c*) passage of blood and mucus with straining.

The *pain* is nearly always the first thing noticed. It has the characters of severe colic and is accompanied by loud screaming and kicking. It goes on recurring at short intervals for a varying period, and then, after perhaps twenty-four or thirty-six hours, paralysis of the bowel sets in and gangrene threatens. The patient then gradually becomes drowsy, and the spasms cease to return.

The *vomiting* is severe and repeated, and generally occurs immediately after the pain begins, though occasionally it is noticed before it.

The *passage of blood and mucus from the bowel with straining* is the other chief symptom, and it is rarely absent when the patient is a baby. It sometimes follows immediately after the other symptoms, but usually there is an interval of some hours. The duration of this interval depends on the situation of the intussusception, being later when the small intestine is involved, and on the degree of congestion of the affected parts. Generally at the first onset of the symptoms there is a forcible discharge from the bowel of any fæces it may contain; and thereafter nothing comes but blood and mucus.

Physical Signs.—The patient is often a fat, well-nourished infant, and in the intervals between the pains he looks fairly well, though there is always some collapse and the pulse is rapid. The degree of collapse varies greatly in different cases; sometimes it is extreme, and the patient presents a typically abdominal facies. The temperature is normal or subnormal at first. If there is any fever, it usually indicates the presence of inflammatory complications.

The abdomen is generally soft and not much distended, and it moves freely with respiration. There may, however, be considerable tenderness over the intussuscepted portion of bowel, and consequent rigidity of the abdominal wall. When this is so, an anæsthetic may have to be given to allow a satisfactory examination.

In the great majority of cases, though not always, a firm sausage-shaped tumour is felt on careful palpation. It may be situated almost anywhere in the abdomen, the exact position depending on how far the invaginated portion of bowel has travelled; often it is situated very superficially. It differs considerably in different cases in size and in mobility as well as in position and hardness. Sometimes the right iliac fossa is felt to be noticeably empty. In intussusception of the small intestine the tumour is generally much more difficult to make out. It is now believed that intussusceptions begin far more frequently in the lower part of the ileum than used to be thought, and less frequently at the ileo-cæcal valve. This part of the bowel owing to its thicker mesentery is specially liable to gangrene.

The lower end of the intussusception may often be felt per rectum, and the examining finger when withdrawn is found to be covered with blood. Even when the intussusception cannot be felt in this way, it may be possible to palpate it easily on bi-manual examination. Occasionally the invaginated bowel is protruded through the anus.

In older children the symptoms of intussusception are often less definite, and the diagnosis, therefore, is more difficult. The onset may be less distinct and the tumour very difficult, or even impossible, to find; and there may be no passage of blood or mucus from the bowel. The obstruction, also, may not be complete, and fæcal matter may therefore continue to be passed.

Diagnosis.—If a trustworthy account of the onset of the symptoms can be obtained, the diagnosis is generally easy, even when the tumour, as sometimes happens, cannot be clearly defined. When any doubt exists, the fullest abdominal and rectal examination under an anæsthetic should be made *at once*, as it is of the utmost importance that the treatment should be begun without the slightest unnecessary delay.

The condition most liable to be mistaken for intussusception is severe ileo-colitis, and the difficulty occurs mainly in older children. In this the onset is not so sudden, the vomiting is less urgent, bile pigment is more likely to be found in the stools, the blood is more intimately mixed with the fæces, no tumour is to be felt, and there is some fever. It is, of course, possible that the two conditions may co-exist.

Course and Progress.—In rare cases complete reduction takes place spontaneously. Occasionally in older children, though scarcely ever in young babies, the invaginated portion of gut sloughs away and is passed with the motions, and the child slowly recovers. Spontaneous recovery, however, is so very uncommon that it can never be expected. If it does not occur and the invagination is not successfully relieved, the child soon passes into a state of collapse and dies, generally within three, four, or five days, sometimes even within twenty-four hours.

Treatment.—There are two methods of treatment which have proved successful in intussusception: (1) distention of the bowel by water or air introduced by the rectum; and (2) laparotomy, with reduction of the intussuscepted bowel by direct manipulation.

1. *Distention of the bowel* from the rectum may be effected by warm water from an ordinary douche apparatus or a Higginson's syringe, but inflation with air by means of a small bellows is more effectual. The child must be fully anæsthetised, and while the air or water is being introduced, the nates should be firmly compressed to prevent return, and the abdomen should be carefully palpated. The proceeding must be carried out slowly and deliberately, and the distention continued for some time. There is considerable danger that the intussusception may be only partially reduced, and may recur. If complete reduction has taken place, a fæcal motion usually occurs shortly after, and the child seems greatly relieved.

2. *Laparotomy.*—The details of the operation need not be considered here. It may, however, be mentioned that the reduction is always to be attempted by manipulating the apex of the intussusception through the sheath, and pressing it up from below, and never by pulling on the bowel above it. When reduction is found impossible, the intussusception may be excised and the cut ends of bowel united, or an artificial anus may be made. Under these circumstances, however, the chance of recovery is extremely small.

Choice of Treatment. — Not very many years ago the mortality from laparotomy in these cases in young infants was so great, even in the hands of distinguished hospital surgeons, that the unsatisfactory proceeding of distending the bowel from the rectum was preferable, because it offered a better chance of recovery. Now the progress of the surgical art has changed this state of things entirely, and there cannot be any doubt whatever that immediate operation by a competent surgeon is altogether better and safer than any other kind of treatment. In proof of this I need only mention that out of twenty-four consecutive cases of acute intussusception operated on by Sir Harold Stiles in the Royal Edinburgh Hospital for Sick Children within thirty-six hours of the onset of symptoms, twenty-three recovered (*i.e.*, 95 per cent.).[1]

The drawbacks to the treatment by distention of the bowel are many and important. At best, it can only be expected to

[1] Full details of the cases of acute intussusception operated on in the Edinburgh Children's Hospital up to May 1906 will be found in a paper by Henry J. Dunbar, *Scot. Med. and Surg. Journ.*, August 1906, xix., 97.

succeed in very recent cases; for though an intussusception has been reduced in this way as late as the seventh day (Cheadle), this is quite an exceptional experience, and even by the end of twenty-four or thirty-six hours the intussuscepted portion of gut will probably have become so much swollen from œdema as to be irreducible. If it fails, much undesirable loss of time will have occurred, because it takes some time to make sure whether the reduction has been complete; and if even a small part remains invaginated, the intussusception will, naturally, soon be as bad as ever again. Should the lesion be situated above the ileo-cæcal valve no effect can, of course, be expected from inflation. There is said to be some danger also of a rupture of the bowel taking place from the artificial distention. In early cases, in young babies this must, however, be very small indeed.

Although it is clear that reduction by the injection of air or water should not be thought of when competent surgical assistance is at hand, this proceeding is by no means to be neglected under other circumstances. Its application during the first few hours after the onset of the illness is probably safer than operation by an inexperienced surgeon would be at the time, or even than operation by a first-rate surgeon some days later. It has the advantage that the necessary apparatus is always obtainable and that its use requires only ordinary sense and tact. It may also be said that if these are used, and the reduction is not effected, no serious harm has been done, and when the surgeon does arrive the operation may still succeed. Distention, moreover, when practised early has been quite often successful. My own experience of it is small, being confined to three cases which were under my care many years ago. In one of these—an older child—the intussusception was only partially reduced, but recovery took place ultimately, portions of the invaginated bowel having sloughed and been passed per anum. The other two cases, which occurred in strong, healthy babies, and were dealt with at an early stage, were completely successful. In all three air was used, though in one, or two of them, water was first tried unsuccessfully.

Appendicitis.

Appendicitis may occur even in breast-fed babies of a few months, and it is not rare at any period of childhood. The symptoms in children differ in no important respect from those in adults, and perforation and gangrene often take place.

Symptoms.—The onset is generally acute, severe abdominal pain with tenderness on pressure on the abdominal wall over M'Burney's point, vomiting often with diarrhœa, a foul tongue, and fever are the first symptoms in most cases. The local hyperæsthesia of the tissues lying over the appendix is an extremely important symptom. It is generally found in the right iliac or lumbar region, but may also be equally distinct elsewhere. The pulse is usually rapid (120 to 140). Sometimes obstinate constipation is present, and occasionally tenesmus. Bladder symptoms and rectal tenderness are common in appendicitis; they are also met with, however, in cases of pelvic abscess, and in general pelvic peritonitis. The temperature keeps up and the vomiting usually continues, and within a few days, in an advancing case, some inflammatory induration can often be made out in the right iliac or lumbar region. In some severe cases the symptoms are very slight.

Diagnosis.—In all cases of acute abdominal disease with local tenderness, quick pulse, and vomiting, appendicitis should be suspected. If there is constant pain, and most of all if there is distinct tenderness on pressure over the appendix region (or even elsewhere in the lower half of the abdomen), this is strongly in favour of the diagnosis. The presence of bladder symptoms is also confirmatory. A rectal examination should always be made in any doubtful case, and is often of great value.

Among the diseases most often mistaken for appendicitis are the following: acute general peritonitis from pneumococcal or streptococcal infection; acute exacerbations of tuberculous peritonitis, such as not infrequently occur from the rupture of a mesenteric gland abscess; acute entero-colitis (which indeed is not very rarely present along with the disease of the appendix); intussusception, and typhoid fever. Strangulation by a Meckel's diverticulum is a rare condition, but when it does occur, its symptoms may be indistinguishable from those of appendicitis. Occasionally simple impaction of hard fæces may also simulate this disease.

Acute pleuro-pneumonia of the right base sometimes gives rise to abdominal pain and acute tenderness very like those of appendicitis. In young children severe attacks of gastric influenza, of Henoch's purpura, and of cyclic vomiting, may also, in their early stages, be difficult to distinguish from it. In girls about the time of puberty symptoms suggestive of subacute appendicitis are sometimes caused by ovarian disturbances. The tenderness in these cases is generally situated lower and is present on both sides. It must be remembered, however, that tenderness of both ovaries may be present in genuine cases of appendicitis.

Treatment.—In watching a doubtful case, it is most important to abstain from giving opiates, which mask the symptoms; also, especially, *to avoid purgatives*, which greatly increase the risk of perforation; and, lastly, to give no food for some time. Acute perforating cases are so common in children that, when the diagnosis is made, the necessary operation should, in the great majority of cases, be done with the least possible delay.

Occasionally a mild form of catarrhal appendicitis occurs with influenza. When this occurs it is advisable that no operation should be performed during the acute stage, as the presence of influenza predisposes strongly to the occurrence of secondary infections (*e.g.*, staphylococcal).

Pneumococcal Peritonitis.[1]

Pneumococcal infection of the peritoneum is commoner in children, especially in young children, than it is in adults. In them also it is more frequently found associated with other pneumococcal lesions, such as those of the lungs, pleuræ, pericardium, meninges, joints, subcutaneous tissue, and ears. Girls are rather more frequently affected than boys. Apart from those due to appendicitis and to tuberculous lesions, the large majority of the cases of acute peritonitis met with in children are of this nature.

Most of the cases of pneumococcal peritonitis are associated with pneumonia, which either accompanies or precedes, or less commonly, follows, the abdominal disease. In some instances

[1] H. Rischbieth, "On Pneumococcal Peritonitis," *Quart. Journ. Med.*, Jan. 1911, iv., No. xiv., 205.

joint-lesions are present; often, however, no source of pneumococcus infection is discoverable. The path of infection need not be discussed here; it is still a matter of dispute among pathologists.

Symptoms.—The onset of the disease is usually abrupt, whether it is accompanied by pneumonia or apparently primary. The child generally complains of considerable pain, and vomits; very often there is severe diarrhœa, and blood may be present in the motions; there may also be dysuria. The tongue is coated and the breath foul, and occasionally there is an eruption of facial herpes. Drowsiness, restlessness and delirium are often present and collapse sometimes occurs; and, from an early stage of the illness, the patient has an abdominal facies (Chapter I.). At first, there is usually rigidity and tenderness of the abdomen with retraction; later, there is more or less distention, with evidence of the effusion of fluid into the peritoneum. The temperature is generally high and irregularly remittent, the pulse feeble and rapid, and there is a high degree of leucocytosis.

When the abdomen is opened in a case of this kind, it is usual to find a large amount of greenish, watery, flocculent pus strikingly devoid of fæcal odour. There must, however, be many cases in which the inflammation becomes arrested before suppuration takes place. I have known a few instances in which laparotomy was performed in cases of croupous pneumonia, with severe pain and tenderness of the abdomen and an abdominal facies, so that implication of the peritoneum as well as of the lung had been diagnosed. In several of them the peritoneum was found to be inflamed to a moderate degree, having lost its lustre, showing a few flakes of lymph on its surface, and containing a little sterile non-purulent fluid. The wound was stitched up without drainage and the children made a good recovery. It seems probable that slight cases of peritonitis of this sort occasionally occur along with, or apart from, pneumonia, and recover without surgical treatment.

Diagnosis.—Acute peritonitis may be suspected to be pneumococcal in origin in any case in which it accompanies or follows pneumonia or empyema; and also in other cases when there are no symptoms of appendicitis, and no suspicion of pre-existing abdominal tuberculosis, a negative tuberculin

reaction, and a high leucocytosis. When there is severe diarrhœa, this is in favour of a pneumococcal origin.

In a few cases, the symptoms are mild and subacute, with little pain or tenderness. In these, a diagnosis of abdominal tuberculosis is apt to be made; and if, as sometimes happens, an abscess forms, this makes things even more difficult.

Acute pleuro-pneumonia with pain referred to the abdomen is liable at times to be mistaken for peritonitis.

Prognosis. — Pneumococcal peritonitis is a very serious disease, and in its acute form is rarely recovered from. In the subacute cases, however, with local abscess-formation, recovery frequently follows surgical treatment; and mild subacute cases have been known to get well spontaneously.

The **treatment** in the acute cases is very unsatisfactory, because the patient is suffering from severe general toxæmia, which cannot be affected by any therapeutic measures at present available.

When recovery does take place, it is generally to be attributed more to the patient having got a smaller dose of the infection than usual, or to his having special powers of resistance, than to the effect of the treatment employed.

The usual surgical procedure consists in free opening and drainage of the peritoneal cavity, and this should be done as soon as possible. An autogenous vaccine may be used in cases that are not too acute to allow the necessary time for its preparation. Anti-pneumococcal serum has also been recommended.

CHAPTER XIV

ON SOME CONGENITAL MALFORMATIONS AND DERANGEMENTS OF THE ALIMENTARY TRACT

In this chapter it is proposed to discuss a few of the congenital malformations of the alimentary tract which are compatible with life for varying periods, and also a group of morbid conditions which probably depend on derangements of the co-ordination of the muscular apparatus in the œsophagus, stomach, and colon. There are reasons for believing that these derangements usually begin during intra-uterine life, although, in most cases, they give rise to no characteristic symptoms till some time after the child is born. As extra-uterine life proceeds, the difficulties arising from the abnormalities of function become more pronounced; and, sooner or later, the clinical manifestations assume their typical characters.

Congenital Malformations.

Congenital Malformation of the Œsophagus.—When an apparently normal baby is found, soon after birth, to be unable to swallow, and anything more than a teaspoonful or two of fluid is at once returned, a malformation of the gullet may be suspected. In the commonest form of this deformity the upper portion, which is greatly widened and hypertrophied, comes to a sudden end—like that of a test-tube—about $4\frac{1}{2}$ inches from the lips, as can be demonstrated by passing a rubber catheter. The lower or gastric portion of the œsophagus instead of joining the upper part opens into the back of the trachea near its bifurcation (Fig. 67). If this communication with the air-passage is not borne in mind, an attempt may be made to

prolong the child's life by performing gastrostomy and feeding him through the wound. This is worse than useless, for, unless something has first been done to close the cardiac opening, whatever is put into the stomach will be regurgitated directly into the trachea. Even if the cardiac end of the stomach were first closed, gastrostomy would not be advisable as the child cannot be expected to live more than a few weeks or months at the most, and no plastic operation is possible. When left alone, the infant may die in a few days, but he usually lives for nearly a fortnight, death being the result of inanition.

FIG. 67. -- Congenital Malformation of the Œsophagus.

Although nothing in the way of treatment is possible, beyond rectal and subcutaneous injections to relieve thirst, it may often be advisable to remove the child to a hospital or nursing home, as his slow death is a peculiarly distressing sight for his parents.

Congenital Obliteration of the Small Intestine may occur in many situations, and may be single or multiple. Its most common site is near the junction of the duodenum and jejunum. In this case, there is enormous distension of the portion of bowel above the obliteration, and well-marked visible peristalsis may occur during life (Fig. 68). The bowel below the obstruction is empty and abnormally small.

For this condition an operation may be attempted, but there is not much likelihood that it will be successful. When nothing is done the child may live for about a fortnight.

A form of **Congenital Intestinal Stenosis** is sometimes met with in which extreme narrowing of part of the second portion

of the duodenum is accompanied by considerable saccular dilatation of its first portion. During life, this condition may be mistaken for pyloric hypertrophy, because there is frequent vomiting along with gastric dilatation and some degree of visible peristalsis. The patient, however, is much feebler than in pyloric hypertrophy, and the visible peristalsis may be observed in the first week, which never happens in that disease.

FIG. 68.—Child with Congenital Obliteration of Small Intestine.

At the post-mortem, what looks at first sight like an hour-glass stomach is found (Fig. 69). Closer examination, however, shows the constriction to be formed of a greatly dilated pylorus. A true hour-glass stomach never occurs in infancy.

Children with this deformity live for a varying number of weeks or months. If it were diagnosed, it is probable that the condition might be relieved by gastro-enterostomy.

Meckel's Diverticulum.—The persistent remnant of the omphalo-mesenteric duct is sometimes found as a blind tube from ½ to 2 inches long coming off from the bowel about a foot above the ileo-cæcal valve. Sometimes the umbilical end of the diverticulum is open, so that there is a fæcal fistula. In the latter case, prolapse of its mucous membrane may occur,

and in infants this gives rise to one form of umbilical polypus. It is easily cured by operation. In some cases the duct is the seat of acute inflammation. In older children with this malformation, it is not very rare to have intestinal obstruction or strangulation occurring from constriction of the bowel by the diverticulum which has remained fixed to the abdominal wall.

In the slighter forms of **Imperforate Anus** in which only the external opening of the bowel is lacking, a simple incision and dilatation has often permanently satisfactory results.

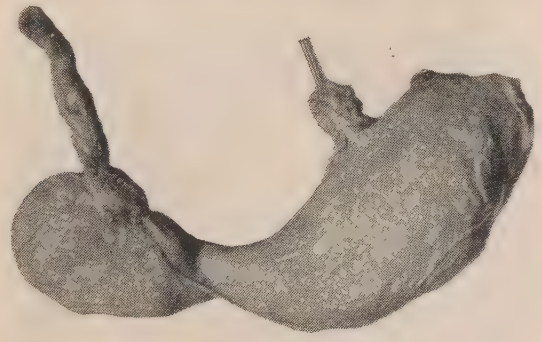


FIG. 69.—Stomach from case of Congenital Stenosis, with Dilatation of Duodenum.

When the bowel ends at some distance from the anal orifice, however, the operation is much more difficult and is often more or less unsatisfactory in its results.

Slight Congenital Narrowing of the Rectum near its lower end is an occasional and important cause of obstinate constipation, which is apt to be overlooked unless a digital examination is made. In some cases of the kind I have known the abdominal distension caused by the rectal narrowing to be so great that the case was mistaken for one of abdominal tuberculosis.

The condition can be satisfactorily treated by a slight plastic operation.

Congenital Functional Derangements.

Dilatation of the Œsophagus (*Spasmodic stricture of the Œsophagus, Cardiospasm, Achalasia of the Cardia,* Hertz).—Dilatation of the gullet with recurring constriction of its lower part is a rare but interesting condition. Its clinical manifesta-

tions are often so obscure at first that it escapes recognition until the patient is several years old. In severe cases, however, its presence may be detected in the early days or weeks of life.

The patient, who is usually a boy, is noticed not to be thriving quite satisfactorily, although he may not be much emaciated, and he frequently returns his milk in considerable quantity some time after taking it. The process is not one of regular vomiting; but a certain amount of each meal is gulped up along with a large quantity of mucus and saliva. At other times, mouthfuls of mucus and saliva come up alone. The saliva is abnormally copious for so young a child, and there is often profuse dribbling. Occasionally, the regurgitation of the milk seems to be painful. The symptoms vary greatly in severity from time to time. At times, when a catheter is introduced, it enters the stomach easily; but generally it is arrested a short distance above the diaphragm. The œsophagus is more or less widely dilated. When a bismuth meal is given, it may pass right into the stomach, but often it is arrested in the œsophagus, and then an X-ray photograph shows that there is a wide saccular dilatation of that organ. This may be mistaken for an œsophageal diverticulum; but it is very doubtful whether real diverticula ever occur in early life in this region.

On post-mortem examination, no organic stricture is found and no localised annular hypertrophy of muscle. The muscular wall of the œsophagus, however, is thickened as the result of its continuous attempts to drive its contents through the obstruction. It has been suggested that the arrest of food near the diaphragm is due to the longitudinal fibres of the gullet, which should open the cardia by their contraction, failing to act in harmony with the rest of the muscular apparatus.[1]

The patient's nutrition is seriously interfered with by the stricture, so that he generally remains undergrown and not very well nourished.

Congenital Hypertrophic Dilatation of the Colon (*Hirschsprung's Disease*).

In examining cases of great distension of the abdomen of long standing in young children, it is well to bear Hirschsprung's

[1] H. D. Rolleston, *Trans. Path. Soc. Lond.*, 1896, xlvii., 37.

disease in mind. In it we find enormous dilatation of the colon, with great thickening of its wall, due to hypertrophy of the muscular coat. Sometimes the whole lower bowel is affected, but often only a portion of the colon is enlarged. In the most typical cases there is no stricture or other obstruction below the dilated part.

Symptoms.—The child, who is nearly always a boy, suffers usually though not always from *extreme* constipation, which dates from birth or, less commonly, from a few weeks after

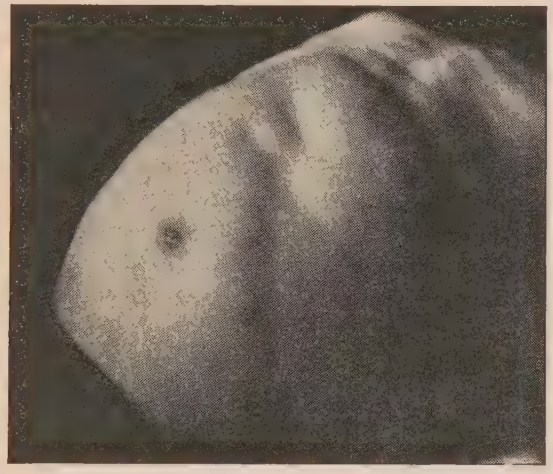


FIG. 70.—Child with Congenital Hypertrophic Dilatation of the Colon.

birth. The abdomen may not be very large at first, but it soon increases in size, and in time may become enormous, displacing the thoracic organs upwards, and ultimately, in some cases, causing œdema of the lower limbs. As the abdomen grows larger, the hypertrophied bowel is noticed from time to time to stand out on the surface, and exaggerated peristaltic movements are seen passing along it (Fig. 70).

At first, and sometimes for years, the child's general health seems little affected. Afterwards, however, it usually suffers, and he becomes thin and feeble, and shows signs of dyspepsia and of toxic absorption from the intestinal tract. In the later stages, which may be reached within the first year or two, or

not until the child is ten or twelve years old, and sometimes not till adult life, diarrhœa sets in, and large slate-coloured, offensive, liquid stools are passed. Towards the end there may also be some rise of temperature. These terminal symptoms probably coincide with the appearance of extensive ulceration in the bowel—the result of the prolonged fæcal retention. Death takes place with symptoms of exhaustion and sepsis, and with dyspnœa from the pressure upwards of the distended bowel. In cases which survive to adult life there is a great risk of volvulus occurring.

The **pathology** of the condition is still very obscure, though many theories have been formed to explain it. It seems not improbable that the primary defect may lie in the nervous mechanism of the bowel. If such a defect existed which gave rise to inco-ordination in the peristalsis, so that one part of the muscular apparatus constantly worked against another instead of in harmony with it, the muscular hypertrophy could be readily explained as the result of the consequent habitual overwork.[1] The "fibrillation" which occurs in the wall of the auricles may possibly be in some respects an analogous condition.

Diagnosis.—The history of the onset of the symptoms and the absence of ascites, glandular masses, or adhesions, should usually serve to distinguish this condition quite easily from abdominal tuberculosis, for which it is sometimes mistaken. It may be distinguished from cœliac disease by the lesser degree of cachexia and the character of the motions.

Prognosis.—Improvement under treatment is common; but it is not probable that complete recovery ever occurs.

Treatment.—Careful *dietetic* and *medicinal* treatment is of considerable value in giving relief during the earlier stages. The bowels should be relieved every two or three days. For this purpose combinations of strychnine, belladonna, and aloes may be used, or magnesia or Carlsbad salts. An occasional dose of calomel is sometimes beneficial, and massage may be useful. Later, recourse must be had to enemata. Extreme flatulent distension of the colon is sometimes greatly relieved by the passage of a long tube into the bowel.

[1] Thomson, "On Defective Co-ordination in Utero as a Probable Factor of Certain Congenital Malformations," *Brit. Med. Journ.*, 6th Sept. 1902, 678.

Several *surgical* operations have been practised with a varying degree of success. Of these, three may be referred to: (1) *Colotomy*—this gives considerable relief by preventing the distressing distension of the colon due to the accumulation of flatus. (2) *Anastomosis*—the ileum being joined to the pelvic colon. The result of this has, in my experience, been disappointing. (3) *Resection of the dilated pelvic colon*—as the dilatation and hypertrophy usually reach right down into the rectum, this operation cannot be completely effected; and subsequent over-distension of the portion left is likely to give rise to trouble.

Congenital Hypertrophy of the Pylorus

(*Hypertrophic Pyloric Stenosis*).

Twenty-five years ago congenital hypertrophy of the pylorus was regarded as a pathological curiosity, and no case of the kind was known to have recovered. Now the disease is recognised as one which any general practitioner may expect to meet with and which he ought to be able to diagnose. It has also now passed out of the ranks of incurable disorders, and, in the large majority of cases, can be treated with complete and permanent success.

Symptoms.—In a typical case of pyloric hypertrophy the symptoms are very characteristic. The patient is a baby of a few weeks old, a boy in four cases out of every five, and he comes of normal or sometimes of distinctly nervous parents. He has usually been born at the full time, after a normal pregnancy and a normal labour.

I have known at least four instances in which two children in a family were affected, one in which the patient's father had suffered from similar symptoms in early infancy, and one in which the mother's brother had died of the disease.

The complaints with which the child is brought to you are the very ordinary ones of *vomiting* and *wasting*, but you will note that there has rarely been any dietetic error adequate to account for the onset of the trouble. Most of the patients have been either on the breast at the time, or else carefully fed on the bottle. If changes have been made in the character of the food, after the vomiting began, it will generally have been noticed that no improvement lasted for more than a day or

two. The only change, if any, which has done good for longer, will probably have been in the direction of lessening the bulk of the fluid taken. Occasionally the vomiting is said to have existed in some degree since birth; but usually it has only begun after a week or two, or after several weeks, of apparently perfect health. The character of the vomiting, when it has lasted for any time, is in most cases peculiar. It is forcible and explosive; and the mother says that the milk shoots out on to the floor through the mouth and nose. The vomited matter is often large in amount, representing more than one meal. It is to be noticed also that, apart from the vomiting, there has usually been a striking absence of many of the ordinary signs of dyspepsia. The tongue has kept clean, and there have been no sour eructations, no flatulent distension of the bowels, usually no bile in the vomit, and no diarrhœa. When the vomiting is severe, the motions are noticeably small and usually dark in colour, and the urine is also scanty.

Along with the vomiting there is generally steady wasting, and the amount of this is of great importance. It is so, because it helps to indicate the degree to which the narrowed pylorus is preventing the passage of food into the bowel, and consequently the degree of urgency of the case. Although the child is very thin, however, he has not the prostrate, drowsy, poisoned look of wasting from dyspepsia. He just seems eager, pained, and exceedingly hungry. The abdomen in cases which have lasted for any time is sometimes spoken of as pear-shaped. Over the stomach region it is distended, and in cases of many weeks' duration the recti are usually hypertrophied and show distinct separation there; while the lower part of the abdomen is small and normal in appearance.

The occurrence during the first weeks of life of such a group of symptoms as is described above should always suggest the possible presence of this disease. They make it, indeed, quite probable, but they do not prove it. Except in very acute cases, a positive diagnosis should *never* be made unless typical exaggerated visible peristalsis of the stomach is seen. It is important also, if possible, to feel the tumour caused by the enlarged pylorus, and to investigate whether the food, when it is not vomited, is retained for an abnormal time in the stomach.

Far the most characteristic and important physical sign of

this condition is the *visible exaggerated gastric peristalsis* represented in Figs. 71 to 76. The outline of the stomach stands out and forcible movements pass over it from left to right. In its most marked degree a rounded swelling, sometimes almost the size of a golf ball, rises up slowly in the left hypochondrium and rolls to the right across the abdomen. By the time it reaches the umbilicus, another is seen following it; and, if the stomach is much dilated, a third may be showing under the left costal margin before the first has disappeared. While this visible peristalsis is going on, the child may show signs of cramp-like pain; generally, however, there seems to be no pain at all. Visible peristalsis may be absent for many hours, even for days at a time, but it will be seen, sooner or later, in all cases that are carefully watched. The best time to look for it is shortly after the child has had a drink. Handling the stomach through the abdominal wall seems sometimes to set it up. In order to be characteristic, this peristalsis must be very marked indeed.

In most cases the enlarged and *hard pylorus* can be distinctly *felt* on palpation, many days before the characteristic peristalsis develops. It may even be noticed to harden and relax alternately under the finger. When the thickened muscle is quite relaxed, however, it is doubtful whether it is ever recognisable by palpation, and sometimes the pylorus is displaced so far backwards under the liver that it cannot, at the time, be made out.

Another important symptom of this disease is the prolonged *retention of food* in the stomach. This can often be readily demonstrated by the use of the stomach tube. If we empty the stomach and then put into it a measured quantity of food—*e.g.* 2 oz. of diluted peptonised milk—we often find that on passing the tube again, two, three, or even four hours later, the same quantity can be removed, if no vomiting has occurred in the interval.

Washing-out the stomach is often instructive. The forcible way in which the water is pumped up the tube indicates that the stomach wall is hypertrophied. Another point which washing-out demonstrates is that the contents of the dilated stomach include a very large proportion of curd—an amount which often represents the solid residue of several meals.

The severity of the symptoms varies greatly in different

FIGS. 71 to 73.—Boy of 8 weeks; Gastro-enterostomy, by Sir Harold Stiles; recovery. (Photographs by Dr T. B. Hamilton.)

EXAGGERATED GASTRIC PERISTALSIS IN CONGENITAL PYLORIC HYPERTROPHY.

FIGS. 74 to 76.—Boy of 8 weeks ; Gastro-enterostomy, by Sir Harold Stiles ; recovery. (Photographs by Dr T. B. Hamilton.)

EXAGGERATED GASTRIC PERISTALSIS IN CONGENITAL PYLORIC HYPERTROPHY.

patients. There is, for example, a severe type of case in which the vomiting is at its worst early—often between the 10th and 20th day of life and many days before any visible peristalsis occurs. It is also so urgent in character that neither restriction of the diet nor lavage has any effect upon it. Such cases are rare, and in them early operation is strongly indicated and generally successful.

In the much commoner moderately severe type, the vomiting is longer in becoming urgent unless the patient is injudiciously dieted; and the peristalsis is generally well-marked long before the vomiting is severe. Many of these cases can be successfully treated by medical measures.

In a third group, although the visible peristalsis is quite typical in character, and the enlarged pylorus palpable, the vomiting is neither urgent nor intractable, and a comparatively slight regulation of the diet with, or even without, washing-out of the stomach is sufficient to stop it, so that no operation is required.

In a good many of the ordinarily severe cases we find that, although the vomiting is rapidly stopped by the treatment, the wasting continues; and, unless an operation is performed, the child is in danger of dying either from inanition or from some intercurrent disease.

On pathological examination, there is not very much difference to be found in the state of the stomach in these different types. It is evidently the functional, rather than the anatomical, abnormality which determines the severity of the symptoms.

In cases in which the pyloric closure is not relieved by the treatment, the muscular strength of the stomach fails after a time. The child is then no longer able to relieve himself sufficiently by vomiting, and, if the stomach-tube is not used, the stomach becomes greatly over-distended and severe catarrh sets in. The child's condition is then serious; and drowsiness, nausea, convulsions, and other signs of gastric toxæmia are apt to follow. When this stage has lasted for some time, treatment is rarely of any use.

The main complication to be guarded against during the treatment of these cases is infective diarrhœa. This is extremely dangerous and often ends fatally in cases which had seemed to be recovering satisfactorily.

Diagnosis. — The clinical features above described are generally so characteristic that they are not easily overlooked by anyone who is acquainted with the condition; but, as has already been said, it is only in a few instances of the most acute and severe type of the disease that we can make sure of the diagnosis from the symptoms alone. Generally we must either feel the pyloric tumour distinctly or observe the characteristic visible peristalsis, before we can be certain of the nature of the case. The typical peristalsis rarely begins before the end of the third week, usually during the fourth or fifth, and often only much later. The pyloric tumour is sometimes felt distinctly by the eighteenth day, but usually it is not palpable till some days later, and occasionally it cannot be made out at all.

The cases most difficult to distinguish from pyloric stenosis are those of an obscure temporary nervous affection of the stomach which has usually been referred to as "**pyloric spasm**." Mild instances of this condition are frequently met with, and give little trouble either in the diagnosis or treatment. Severe cases may cause great difficulty, but they are uncommon. They are not only difficult to recognise at first but also very resistant to treatment, although they nearly all recover completely in time.

The patient is often a girl, and there is generally much more evidence of pain than in cases of pyloric hypertrophy. The vomiting usually occurs shortly after each feed and the whole contents of the stomach are returned at once, or else it recurs at short intervals until the stomach is emptied. There is little or no tendency for the food to accumulate in the stomach, and there are no other signs of gastric dilatation or hypertrophy. Before the vomiting, the outline of the stomach may occasionally stand out distinctly, but there is never any characteristic peristalsis to be seen. The motions and urine are scanty, and sometimes slight diarrhœa occurs.

Cases of pyloric spasm require the greatest care and perseverance in their treatment. The diet must, of course, be regulated and the stomach should be washed out regularly, if this is found to have any good effect on the vomiting. Often, however, these measures have disappointingly little influence on the habitual return of the meals. The treatment

which I have found most useful is the cautious administration of small doses of laudanum, beginning with $\frac{1}{40}$ minim, and gradually increasing to $\frac{1}{10}$, or even to $\frac{1}{5}$ minim. When this succeeds in lessening the vomiting, the weight steadily rises. These cases, if the mother is careful and trustworthy, often do better at home than in hospital, and home-treatment is also preferable for them because, like cases of pyloric hypertrophy, they are apt to go down rapidly if they are infected with diarrhœa. On post-mortem examination, the pylorus and stomach are found to be quite normal.

Congenital stricture of the second part of the duodenum with dilatation of its first portion (p. 279) is sometimes mistaken for pyloric hypertrophy on account of the presence of vomiting and visible peristalsis. In this condition, however, the vomiting is never very forcible and the visible peristalsis, which also is not severe in degree, begins earlier. The patient also is generally feeble from the first, which is rarely the case in pyloric hypertrophy.

Cases of congenital hypertrophy of the pylorus are occasionally met with, in which the diagnosis is obscured in the early stages by the slightness of the vomiting. In these, the mother lays stress on the child's wasting and on his disinclination for all food, and says little, or even nothing, about his vomiting. The use of the stomach-tube and the presence of characteristic peristalsis should soon make the diagnosis clear; and whenever the child's disinclination to take food is even partially overcome, the vomiting assumes its usual prominent place among the symptoms.

Another class of case in which the diagnosis is apt to be overlooked is that in which severe gastro-enteric catarrh has occurred early, from injudicious feeding and prolonged food-retention. Such cases may require close study for days before the diagnosis is established; and the state of debility usually present makes the prognosis grave in most instances.

I have known of a number of cases in which the vomiting and constipation of pyloric hypertrophy have been attributed to cerebral disease.

Etiology. — The question of the origin of the muscular hypertrophy in this disease and its relation to the pyloric obstruction are still matters of dispute.

On the one hand, there are those who hold with Hirsch-

sprung[1] and Cautley that the condition is a primary congenital hyperplasia, and that the abnormalities of its function are the result and not the cause of the muscular enlargement.

On the other hand, there are many who agree with the present writer[2] in maintaining that a true muscular hypertrophy of this sort *never* occurs as a primary phenomenon, but is always the result of antecedent overaction; and who therefore hold that, to account for the presence of such hypertrophy as we find in these cases, we must assume that some cause of habitual overwork—such as inco-ordination between the stomach and the pylorus—must have existed for a long time previously. Even a slight degree of inco-ordination between the action of the stomach and that of the pylorus would be sufficient to produce serious overaction of the kind suggested. It is in keeping with this hypothesis to regard the disease as probably beginning *in utero;* for the co-ordination between the stomach and pylorus begins long before birth, when fluids first pass through them. We are, therefore, justified in retaining the term "congenital" in the name of the disease (see also Heubner,[3] Cunningham,[4] and Wernstedt[5]). It is probable, however, that the muscular hypertrophy is not large in amount at the time of birth, but that it rapidly increases after feeding with milk has begun. As the result of careful palpation, of inspection during operation, and of post-mortem examination, it is believed that the pyloric tumour goes on increasing in size as long as the active symptoms continue.

Morbid Anatomy.—The condition found on post-mortem examination is a very simple one, and it is interesting to observe how it corresponds with the symptoms.

The essential *structural* change is confined to the upper portion of the alimentary tract. It consists in a high degree of pure hypertrophy of the muscular coat of the pylorus and adjacent stomach wall, and a lesser amount of the same

[1] *Jahrb. f. Kinderheilk*, 1888, xxviii., 61.

[2] *Brit. Med. Journ.*, 1895, ii., 711; *Edin. Hosp. Rep.*, 1896, iv., 116; *Scot. Med. and Surg. Journ.*, 1897, i., 511; *Brit. Med. Journ.*, 1902, ii., 678.

[3] "Ueber Pylorospasmus," *Therapie der Gegenwart*, Oct., 1906.

[4] *Trans. Roy. Soc. Edin.*, vol. xlv., pt. i., No. 2, 1906, 23.

[5] *Nord. Med. Arkiv.*, 1906, xxxix., Afd. ii., No. 2, 65; *Jahrb. f. Kinderheilk.*, 1907, lxv., 674.

thing in the cardiac end of the stomach and in the œsophagus. The other changes present, such as dilatation and catarrh of the stomach, and the general marasmus, are obviously secondary results of the pyloric hypertrophy and of the obstruction which it causes.

FIG. 77.—Dilated stomach from child of 9½ weeks with Congenital Pyloric Hypertrophy.

The tumour of the pylorus which the muscular hypertrophy occasions is very striking, especially in long-standing cases. It forms a hard, tense, elastic swelling, bulging in the centre (Fig. 77). The peritoneal coat is distended to its utmost limit, and so tightly stretched by the increased bulk of the muscle within it, as to be circular on transverse section (Figs. 78 and 79). Its inability to stretch further is a point of practical importance, for it results in the mucous and submucous coats becoming increasingly compressed as the muscular coat thickens and thus it constitutes an active

FIG. 78.—Transverse Section of Normal Pylorus, near the Duodenum, × 4 diam. From a child of 9 weeks.

FIG. 79.—Transverse Section of Hypertrophied Pylorus, near the Duodenum, × 4 diam. From a child of 9 weeks.

element in the obstruction of the pyloric lumen. The apparent narrowing of the mucous coat as seen on section (Fig. 79) may be due to this compression and partly to elongation caused by the contractions of the hypertrophied muscle. The apparent thickening of the submucous coat and the folds in the mucous membrane are also probably due to the compression exerted by the surrounding muscular tissue.

The essential abnormality of *function* is as strictly localised as that of the structure. It consists in an ill-timed, abnormally forcible, and prolonged contraction of the pyloric muscle. This prevents the passage of the food from the stomach into the bowel, thus accounting for the starvation and wasting, the thirst and drying up of the tissues, and the scantiness of the urine and fæces—and, in conjunction with the muscular hypertrophy of the stomach wall, leading to the forcible vomiting.

There is, however, another important factor in the closure of the pyloric lumen, besides the abnormal muscular contraction, to which sufficient attention has not been given.[1] This is the mechanical blocking which arises from the steadily increasing bulk of the muscle on the one hand, and the somewhat unyielding character of the peritoneal coat on the other (Figs. 78 and 79). This second factor does not come into play in the early days of life, and only begins to tell during the second or third week or later, when the muscle has grown considerably in thickness. Consequently it is only then that symptoms of severe obstruction appear; and the difference in the rate of the muscular hypertrophy in different children is apparently the explanation of the varying dates of onset of the urgent symptoms.

Treatment. — In considering which form of treatment—medical or surgical—should be resorted to, it is important, to begin with, to study what we may call the *natural course of recovery* and to realise that the disease is in a sense self-limited; that is to say, that the pylorus will open up spontaneously in time and the child recover, provided he does not die in the process. When recovery occurs in this way we know, from the results of post-mortem examinations, that the muscular coat remains thickened for a long time after its action

[1] Thomson, *Contributions to Medical and Biological Research, dedicated to Sir Wm. Osler*, 1919, 1010; and *Edin. Med. Journ.*, Jan. 1921.

has become quite normal. This natural process of cure is illustrated in Figs. 80 and 81; both represent a weekly weight chart from a severe and obstinate example of the ordinary type which was carefully and successfully treated by dieting and lavage. It shows, in a typical way, what usually happens under such circumstances. There is first a period of several weeks during which the food passes into the bowel in sufficient amount to allow a steady gain in weight and vigour. Then,

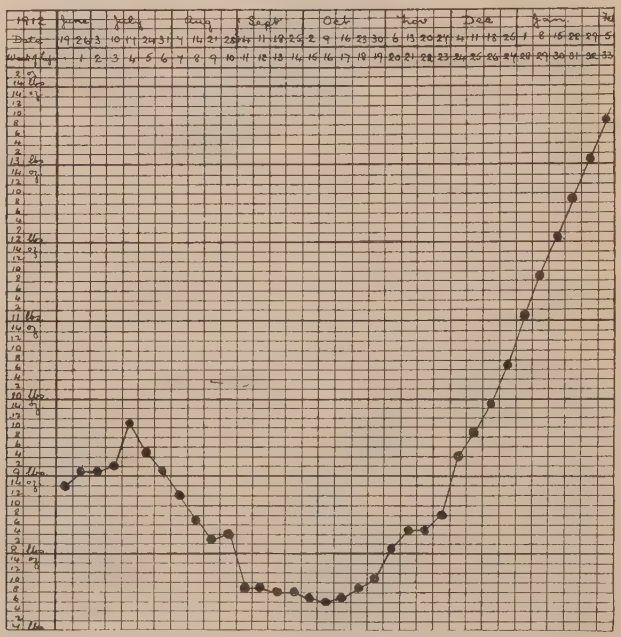


FIG. 80.—Weekly Weight-Chart from medically treated case of Congenital Pyloric Hypertrophy.

as the lumen becomes increasingly obstructed by the thickening muscle, the loss of weight and the vomiting become more and more severe and the weight falls rapidly, in spite of all treatment. In severe cases, no medical measures are capable of stopping this loss of weight at first; but, with careful feeding and stomach-washing, it is often possible to diminish or arrest it after some weeks; and, at the end of a month or two, during which the weight has remained stationary, the natural process of recovery sets in. The improvement which now begins is probably due to the peri-

toneal tube gradually enlarging, the abnormal contractions of the muscle lessening, and the muscular hypertrophy slowly subsiding. When once the gain in weight has begun, it is usually rapid and continuous and the child is soon practically well.

What the physician expects to do, therefore, in treating an early case is not to make the child gain weight quickly, for no medical treatment is known which will accomplish

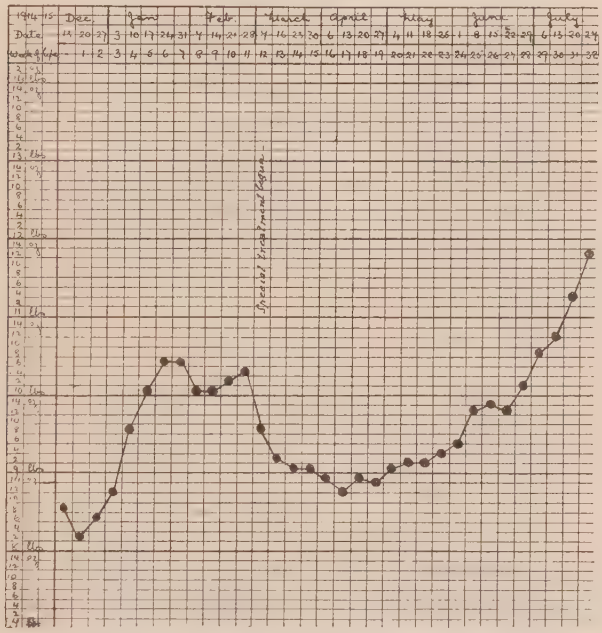


FIG. 81.—Weekly Weight-Chart from medically treated case of Congenital Pyloric Hypertrophy.

that at this stage, but to induce the narrowed and irritable pylorus to let through enough nourishment to keep the child alive until Nature's slow process of cure has had time to develop.

Most cases of pyloric hypertrophy can be successfully treated by medical measures only, provided they do not belong to the very acute type and that they are under proper care from the first onset of the symptoms until the natural process of recovery has fairly begun. In the acute cases, the loss in weight and strength is so rapid that the risk

of an operation is far less than that of prolonged medical treatment; and the same is true in the case of even moderately severe cases, unless close attention and very careful nursing can be supplied. If an operation is performed, and is successful in securing the free passage of food into the bowel, the weight begins to increase rapidly almost at once (Figs. 82 and 84).

If this end is not attained, however, the weight will remain stationary for many weeks as in the medically treated cases (Fig. 83). The *choice of treatment*, then, depends largely on the degree of severity of the case in hand. In early cases, this can be found out partly from a consideration of the symptoms and from the present state of the child, but chiefly by observing the result of a short preliminary course of treatment by restricted diet and lavage. I usually begin by giving 1½ to 2 oz. of dilute peptonised milk every two or three hours and gradually increase the amount; the stomach should also be washed out once or twice daily with plain warm water.

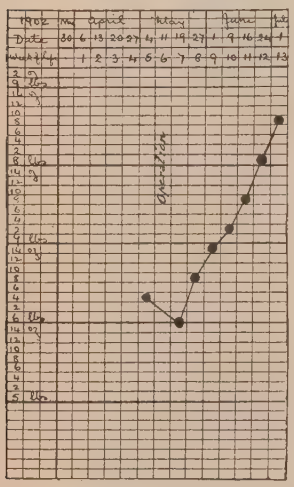


FIG. 82. — Weekly Weight-Chart from case of Congenital Pyloric Hypertrophy treated by Loreta's Operation, showing immediate gain in weight.

In the very mild type this treatment has an immediate effect in stopping the vomiting and initiating a gain in weight, and its continuance is all that is necessary. In the ordinarily severe cases, the vomiting is almost always stopped or much diminished at first by it; but it is apt to recur badly whenever an attempt is made to increase the food to a normal amount. In the severe and acute type, the vomiting and loss of weight are not influenced at all by this treatment. Many hospital cases, and some of those seen in private practice, are only brought for treatment after a long course of injudicious feeding; and we find that they are in a state of collapse and toxæmia, with gastric dilatation and catarrh, and are suffering acutely from thirst and drying up of the tissues. In these the chief indication is to wash out the stomach at once, to stop all food and fluids by the mouth for twenty-four hours at least,

and to give subcutaneous infusions of normal saline solution (3 to 6 oz. into the back or flanks every four to six hours).

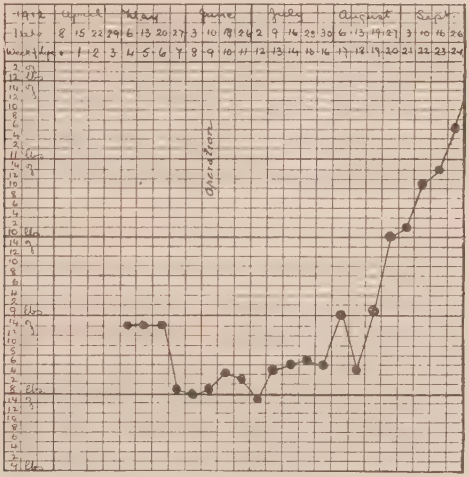


FIG. 83.—Weekly Weight-Chart from case of Congenital Pyloric Hypertrophy treated by Loreta's Operation, showing delayed gain in weight.

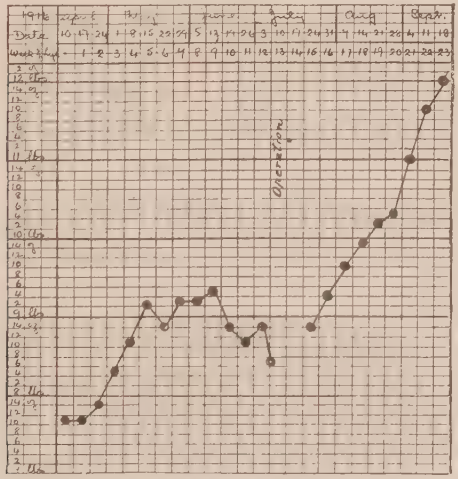


FIG. 84.—Weekly Weight-Chart from case of Congenital Pyloric Hypertrophy treated by Rammstedt's Operation, showing immediate gain in weight.

The effect of these on the patient's strength and comfort is very striking, and generally the child is not put about by them at all. In a few cases, however, the subcutaneous

tissues are specially sensitive and the injections cause so much pain that they have soon to be discontinued. Nutritive enemata are of little or no use, but it is always well, if possible, to supplement the subcutaneous injections by saline enemata (an ounce or two every four to six hours given slowly through a small catheter). These injections have to be given very carefully as they are apt to be returned; but many children can retain them regularly for several days. Some resent them even more than they do the saline infusions.

If, after two or three weeks, in an ordinary case, the child is failing to respond to medical treatment, and is losing ground, and sooner in some bad cases, a surgical operation should be advised without further delay.

The application of a series of hot fomentations to the abdomen, and the administration of sedatives such as opium or atropin have been recommended as useful auxiliary measures, but I have never found any decided advantage from their use.

Surgical Operation.—The chief operations which have hitherto proved successful are four in number. These are (1) gastro-enterostomy, first performed with success by Löbker (1898)[1] and Kehr (1899)[2]; (2) forcible stretching of the pylorus (Loreta's operation), introduced by Nicoll of Glasgow in 1900[3]; (3) pyloroplasty, which has been advocated by Cautley and Dent, and successfully performed by the latter in a number of instances, the first being in 1902[4]; and (4) simple division of the circular muscular layer of the pylorus by an external incision through the peritoneal coat without opening the stomach and without stitching. This was recommended by C. Rammstedt of Munster in 1913.[5]

From a comparison of the published results of 135 operations Dufour and Fredet[6] give the mortality of the older operations as: gastro-enterostomy 57 per cent.; Loreta's operation, 42 per cent.; pyloroplasty 41 per cent.; and various combinations and modifications of these 52 per cent.

[1] *Verhandl. d. deutsch. Gesellsch. f. Chirurgie*, 29 Kongress, 1900, i., 148.
[2] *Ibid.*, p. 124; and Abel, *Münch. med. Wochenschr.*, 1899, xlviii., 1607.
[3] *Brit. Med. Journ.*, 1900, ii., 571.
[4] *Med. Chir. Trans. Lond.*, 1903, 474.
[5] *Zentralbl. f. Chirurgie*, Leipzig, 1913, xl., 3.
[6] *Revue de Chir.*, 1908, xxxvii., No. 2, 208.

In a recent paper,[1] Holt mentions that in forty-one cases of gastro-enterostomy on his patients the mortality was 51 per cent., while in sixty-seven in which Rammstedt's operation was performed it was only 24 per cent.

Among 100 cases of congenital pyloric hypertrophy under my care during the last twenty-five years there were fourteen cases of gastro-enterostomy with a mortality of 64 per cent., and eighteen of Loreta's operation with 61 per cent. of deaths. In five in which Rammstedt's operation was done the mortality was 20 per cent.

I agree with Holt and other recent writers that this operation is superior to any of the others and should always be preferred to them.

It is extremely difficult, indeed impossible, to draw satisfactory comparisons between the published operative results of different surgeons without the fullest information regarding the cases dealt with, because many of the unsuccessful cases are not published, and also because the chances of recovery depend so very much on the state of the patient at the time. The earlier statistics generally show a much higher mortality than those published recently. This is partly because it was only in very severe cases that the disease was diagnosed in the earlier days; and, largely also because the nature of the cases was scarcely ever recognised at that period before they were brought to hospital, so that the patients were often in a state of collapse from the results of improper dieting when the operation was performed.

A most striking fact with regard to the statistics of operation in my cases has been the very much better results obtained in private than in hospital practice. The mortality of the twenty-eight hospital cases operated on was 78 per cent., and that of the private cases 18·2 per cent. Similarly, in the case of the children treated by medical measures only (excluding seven of them who died within a few days of being first seen and before treatment could be properly begun), thirty-one hospital cases showed a mortality of 74·2 per cent., while that of the twenty-three cases treated throughout in private was only 21·7 per cent.

There are at least three obvious reasons for this great difference. The first is the state of extreme debility in which

[1] *Brit. Journ. of Children's Diseases*, July to Sept., 1917, xiv., 161.

many of the hospital babies were on admission, owing to former injudicious treatment; the second is the great danger of infectious diarrhœa in hospital practice during the summer and autumn months; and, lastly, there is the much greater amount of individual nursing, care, and mothering which can be given to the infants of well-to-do parents who can have the whole attention of competent nurses both by night and day.

Except in the most severe and acute type of case, it is always desirable that the patients should be carefully treated by medical measures for several days before an operation is performed; for it is seldom that they cannot be so much improved by such treatment as to be better able to stand the operation.

If the operation is successfully performed so that the pyloric lumen is freely opened up, or an adequate opening made between the stomach and bowel, all the symptoms cease in a week or two, and the patient makes a rapid recovery. In many cases of the older operations, immediate relief did not occur, and the symptoms continued for weeks before recovery set in (Fig. 83). In such cases, continued medical treatment is most important; because the bowel is apt to resent the sudden increase of its contents and there is a danger of diarrhœa occurring. Delay in recovery of this sort, however, will probably be rarely found to occur after Rammstedt's operation; but fatal hæmorrhage occasionally takes place after it.

Condition in After-life of the Patients who Recover.—Of my first hundred cases[1] of the disease forty-two recovered—fourteen of them after one operation, two after two (Loreta followed by gastro-enterostomy), and twenty-six on medical treatment only. Five of the children have since died from various causes not connected with the stomach, and four, who were doing well at various ages when last seen, have been lost sight of. The remaining thirty-three, whose present ages vary from ten months to sixteen and three-quarter years, are all in good health, and most of them, doubtless owing to the special care they have had, are above the average in vigour and development. A few suffered for two or three years at first from recurrent vomiting attacks; but now they are all free from gastric symptoms. Dr J. H. Nicoll's first patient, who

[1] For details of these cases, see *Contrib. to Med. and Biol. Research dedicated to Sir Wm. Osler*, 1919, 1010; and *Edin. Med. Journ.*, Jan. 1921.

was the first case in Great Britain to recover from an operation for this disease, is now past eighteen; he was examined for the Army in 1918 and passed as A1.

It seems certain, therefore, that the danger of the disease to life and even to health is merely temporary, and that the patients who have suffered from it in infancy are in no way handicapped thereby in later life. So far, those children who were operated on seem to have thriven just as well as those who were medically treated.

CHAPTER XV

ON DISEASES OF THE LIVER

THE liver is a very important organ in young children and, relatively to the rest of the body, it is about twice as large in them as it is in adults. Notwithstanding its size and its physiological importance it is, in temperate climates at least, far seldomer affected by disease in childhood than in later life. When we do meet with instances of hepatic disease in children, however, they are often cases of special interest; although, unfortunately, the interest is apt to centre more in the diagnosis and prognosis than in the treatment.

When a young baby is jaundiced, the first question we ask ourselves is whether it is merely a case of icterus neonatorum (physiological jaundice) or if there is a pathological cause for the symptom. In the latter case, we may have to do with catarrhal jaundice, with some form of infective disease, with congenital syphilitic affection of the liver and its ducts, with congenital obliteration of the bile-ducts, with congenital family cholæmia, or possibly with a hepatic neoplasm. Jaundice is also a prominent symptom in Buhl's disease (fatty degeneration of new-born children) and in Winckel's disease (epidemic hæmoglobinuria). These are two rare affections of newly-born children which have been described as occurring in continental maternity hospitals, but which rarely, if ever, occur in this country.

Far the commonest form of jaundice in older children is the ordinary catarrhal variety which is often associated with symptoms of gastric catarrh. If the jaundice is prolonged, severe, or recurrent, we should think of such diseases as hepatic cirrhosis, "subacute liver atrophy," and congenital family cholæmia; and possibly of hydatids of the liver or of gall-stones. Jaundice is also occasionally met with as an

incident in the course of various other diseases such as abdominal tuberculosis and advancing abdominal tumours.

Icterus Neonatorum (*Physiological Jaundice*).

In new-born children the skin is of a more or less deep red colour all over the body. This gradually fades, leaving in most cases a yellow tinge. When the yellow discoloration is marked, it is spoken of as icterus neonatorum, or physiological jaundice. It is generally noticed first on the second or third day after birth, and is never present when the child is born. After increasing in depth for a day or two, it gradually diminishes, and is usually gone within a week or ten days. In rare cases, it may persist for several weeks.

The explanation of this phenomenon is still obscure. It is certain, however, that it is a form of hepatogenous jaundice, and not, as was formerly held by some, hæmatogenous in origin, nor, as others have thought, merely a local discoloration due to the red of the hyperæmic skin turning yellow as a bruise does in the process of fading. It seems probable that at birth, owing to the active destruction of red blood-corpuscles, a specially large amount of highly pigmented bile is secreted, but how this finds its way into the general circulation is still undetermined.

The discoloration differs from that in ordinary obstructive jaundice both in its distribution and in the order of its appearance. It is first seen on the face and chest, later on the sclerotics, and last of all on the hands and feet. Compared with the skin, the sclerotics are slightly affected and they may remain normal in colour, while in ordinary jaundice they are among the parts earliest and most deeply discoloured. The urine also generally remains quite normal in appearance and the fæces are always so. In other respects the child is perfectly well.

The diagnosis of icterus neonatorum rarely presents any difficulty. The absence of serious symptoms, the slight degree of the jaundice, the normal urine, and the coloured motions suffice to distinguish at once even extreme instances of this condition from cases of infective or catarrhal jaundice, and from those which depend on syphilitic or other disease of the liver or on congenital obliteration of the bile-ducts.

Jaundice from Umbilical Infection.

Infective jaundice is often due to streptococci or other organisms spreading by the umbilical to the portal vein and thence to the liver. Streptococcal inflammations of the pleura, peritoneum, or meninges may also be present.

The **symptoms** are local and general.[1] The former consist in suppuration of the umbilical wound, with redness and swelling of the surrounding skin. The latter, which set in during the first two days of life, are irritability, sleeplessness, refusal of the breast, vomiting, and green diarrhœa. The jaundice increases, and there is more or less cyanosis and sometimes œdema. The temperature reaches 102° to 104° F. Hæmorrhages, which may be fatal, sometimes take place from the umbilicus or bowel. When the general infection is severe, the infant always dies within a few days in a comatose condition.

The **treatment** is mainly prophylactic, and consists in scrupulous attention to aseptic precautions in the management of the umbilical cord.

Jaundice from Intestinal Infection.

This is a commoner condition than that which originates in the umbilical wound. It may occur in epidemics or sporadically, and is said to depend on infection by *bacillus coli* and *bacillus lacticus*.[2] The bile-ducts are normal and the liver and spleen are little, if at all, enlarged. The intestine shows a slight degree of desquamative enteritis.

The **symptoms** set in rapidly without apparent cause, the mother being quite healthy. The child refuses the breast, vomits, and may have a slight convulsion. Jaundice, cyanosis, and diarrhœa soon follow. The motions are not decolorised. The cyanosis is a characteristic feature. It usually modifies the yellow tint to a sort of bronze, and may mask it altogether. The diarrhœa is of a peculiar character; it is not severe and may therefore be overlooked. At first, there may be only three

[1] Porak et Durante, *Arch. de Méd. d. Enf.*, Paris, 1901, iv., 321.

[2] Lesage et Demelin, "De l'ictère de nouveau-né," *Rev. de méd.*, 1898, xviii., 1.

or four pale green alkaline or neutral motions in the twenty-four hours; these are passed without pain, and the abdomen remains soft and natural. In fatal cases this condition of the stools continues until death. When recovery sets in, however, the character of the motions changes; they become more frequent (seven to ten) and are bright green in colour and acid in reaction. The general infection gives rise to drowsiness, slight fever, and emaciation. The duration of the disease is from three to twelve days.

The **diagnosis** of this form of infective jaundice depends on the absence of an umbilical lesion, on the lower range of the temperature (not much over 100° F.), and on the absence of other infective lesions such as pleurisy, peritonitis, and meningitis.

The **prognosis** is grave, the mortality being about 30 per cent. Severe cyanosis, high fever, and profound drowsiness are all unfavourable signs. The passage of an increasing number of highly bilious and acid stools is of good omen.

The **treatment** consists in attention to the general hygiene, the administration of small doses of calomel, and especially in the use of subcutaneous injections of normal saline solution. Great care must be taken in the disinfection of the motions.

Jaundice from Congenital Syphilis.

The common form of intercellular syphilitic cirrhosis with, or more usually without, miliary gummata, does not cause jaundice. Occasionally, however, a severe degree of jaundice is met with in syphilitic cases, as the result of pericholangitis or from obstructive disease of the bile-ducts.[1] In such cases there are usually hæmorrhages in some situations, and death occurs with profound cachexia, in spite of anti-syphilitic treatment. The only features which distinguish the condition from congenital obliteration of the bile-ducts (which has nothing to do with syphilis) are the presence of syphilitic symptoms in the parents, other indications of the disease in the child, and the severe cachexia.

[1] Beck, *Prag. med. Wochenschr.*, 1884, ix., 257, 266, 284; H. D. Rolleston, *Brit. Med. Journ.*, 1907, ii., 947.

On Congenital Obliteration of the Bile-Ducts.[1]

Under the heading "congenital obliteration of the bile-ducts," a series of cases of congenital jaundice are described in which there is a varying degree of obstruction, or an actual disappearance of the bile-ducts, often with signs of past inflammation of these parts and with biliary cirrhosis of the liver.

Etiology.—The disease has occasionally been reported as occurring in several children in a family, and, in some instances, multiple malformations of other organs have been found along with it. There are generally no grounds at all for attributing the lesion to congenital syphilis, although a few cases of obstruction of the ducts due to this disease have been placed on record (Beck,[2] Rolleston[3]).

Pathology.—The degree to which the bile-ducts and gall-bladder are affected varies very greatly. In a few cases, the ducts are only slightly obstructed or thickened; but usually their lumen is entirely obliterated or portions of them have entirely disappeared. The obliteration may be situated at any part of the ducts, or it may affect the gall-bladder only. The portion of the duct above the obliteration is sometimes greatly distended. In a few instances gall-stones composed of inspissated bile have been found in the ducts. The liver is always in a state of biliary cirrhosis, if the child has lived for any length of time. The pancreas may or may not be affected with fibrosis, and the spleen is generally much enlarged. The inflammation in and around the ducts very rarely spreads to the peritoneum.

It is probable that the obliteration follows inflammatory changes which have set in as the result of a previously existing congenital narrowing of developmental origin; the consequent stagnation of bile is responsible for the hepatic cirrhosis.

Clinical Features.—The parents are generally healthy, although, in some instances, they have had several other

[1] Beneke, *Die Entstellung der kongenitalen Atresie der grossen Gallengänge* Universität Programm, Marburg, 1907; J. B. Holmes, *Amer. Journ. Dis. Child.*, June 1916, xi., No. 6, 405; L. S. Milne, *Quart. Journ. Med.*, July 1912, v., No. 20, 409; J. Thomson, *Edin. Med. Journ.*, 1891-92, xxxvii., 523, 604, 724, and 1112; and Allbutt and Rolleston's *Syst. of Med.*, 1908, iv., pt. 1, 103.

[2] *Prager Med. Wochenschr.*, 1884, ix., 257, 266, and 284.

[3] *Brit. Med. Journ.*, 1907, ii., 947.

children affected with congenital jaundice apparently of the same nature. Boys are more frequently affected than girls (41 : 26).

The child is well nourished at birth and appears normal until the whiteness of the stools and the persistent jaundice are noticed. The jaundice usually appears on the second or third, but occasionally not until the tenth or fourteenth day, and sometimes even later. It is slight at first, but steadily deepens, and the skin soon assumes a dark greenish yellow hue which persists till death, though it often varies a little in intensity from day to day. The motions are generally colourless from the first, but several cases have been reported in which meconium of the usual colour has been passed before the stools became white. The urine is generally deeply bile-stained.

A characteristic complication in these cases is the occurrence of spontaneous hæmorrhages from various situations. Sometimes the bleeding is from the umbilicus (fifth to ninth day), and this form is usually fatal. Patients who survive the first fortnight may have bleeding into the subcutaneous tissues or from the nose, stomach, or bowel. When no complications occur, the disease seems to cause comparatively little interference with the general health and a considerable proportion of the children live for many months (three to ten); but no case in which the diagnosis was confirmed post-mortem, has survived the first year. Towards the end, emaciation, debility, and sometimes convulsions occur.

The **diagnosis** may present some difficulty at first; but the colourless motions, the deeply bile-stained urine, and the increase of the jaundice during the second week, soon show that there is something more serious the matter than icterus neonatorum, and the absence of severe cachexia also differentiates the condition from infective and syphilitic disease.

Treatment.—While medical treatment is quite useless, it is possible that relief might be obtained in a few instances by a surgical operation, if it were done early, before the liver has had time to become seriously diseased. From a consideration of the post-mortem conditions found in the published cases, Holmes concludes that 16 per cent. of them might have been operated on with, at least, some chance of success by making an anastomosis between the duodenum and the gall-bladder or a part of the bile-duct above the obliteration. Considering that

the prognosis is otherwise hopeless, an operation of this kind may be regarded as justifiable, but the chances of its being successful are certainly very small indeed.

On Congenital Family Cholæmia

(*Congenital Acholuric Jaundice*).

In examining obscure cases of jaundice in children, it is well to bear in mind the rare disease known as "congenital family cholæmia," as its symptoms in many cases begin in infancy. The condition is almost certainly to be regarded as a form of hæmolytic jaundice arising from some congenital defect in the blood-forming organs—the disturbance of the liver-function being merely secondary.[1] As it is apt, however, to be mistaken for forms of jaundice due to liver-disease, it may conveniently be considered here. Its pathology and its relation to other infantile affections of the hæmopoietic organs are still very obscure. The clinical manifestations also vary in detail to a considerable extent according to different observers; and it seems not improbable that further study may reveal the existence of several distinct types of the disease.

Clinical Features.—The disease is in many cases hereditary; and, when this is so, the sexes are equally affected and transmission occurs either through males or females, but never through members of the family who have no symptoms of the disease.

The patients are curiously free from subjective symptoms, even when the degree of jaundice they present is considerable; and the disease does not apparently lead to debility or tend to shorten life. The chief physical signs are great enlargement of the spleen, certain changes in the blood, and a degree of persistent jaundice.

The splenic enlargement is present from the beginning and the organ reaches to or even below the level of the umbilicus. In a few cases severe pain is complained of in the splenic region, which may be connected with the perisplenitis which, along with general fibrosis of the spleen, is usually found on post-mortem examination.

[1] F. J. Poynton, *Lancet*, 15th Jan. 1910, 153; A. W. Mackintosh, A. W. Falconer, and A. G. Anderson, *Edin. Med. Journ.*, Feb. 1911, 101.

The blood-serum always contains bile-pigment but often no urobilin. The red corpuscles are diminished in number and show a lowered resistance to hæmolysing agents such as saline solution; there is often also a degree of poikilocytosis and microcytosis instead of the megalocytosis which is usual in obstructive jaundice; nucleated red cells are common. The colour index is normal. The leucocytes are normal in number and in their relative proportions, but various abnormal forms are often found. Occasionally slight epistaxis or hæmorrhage from the gums or elsewhere is met with, but dangerous purpuric symptoms never occur.

Soon after birth, in most cases, a mild degree of jaundice begins to appear gradually, and this persists through life. It increases during the periodic exacerbations but is never extremely severe. During the exacerbations the liver is also enlarged, but at other times it is normal in size.

The urine is in most cases altogether free from bile-pigment, but urobilin is generally to be found in it. In other respects it is quite normal. The fæces are always well coloured.

It is very characteristic of the disease that exacerbations occur from time to time with varying frequency. Sometimes there is no apparent cause for their onset, but they may occasionally result from excess in eating or drinking, from bodily or mental strain, or from exposure to cold or heat. In these attacks there is a slight rise in temperature, an increase in the jaundice, usually some enlargement of the liver, distinct increase in the anæmia and in the size of the spleen, often also a heavy deposit of urates in the urine, and a deeper coloration of the fæces.

No treatment can be regarded as of any value beyond attention to the general health and avoidance of the known causes of exacerbations.

Catarrhal Jaundice.

Catarrhal jaundice is a fairly common disease in older children. Occasionally it occurs as an epidemic in a family or school without any apparent cause; and it is met with frequently in some influenza epidemics. Its clinical features are the same as in later life. In early infancy it is comparatively rare, but it may occur even during the first few

weeks of life. At this age it is to be diagnosed by the absence of the special symptoms of the other forms of jaundice which occur in young infants, by the gastric symptoms which accompany it, and by the patient's recovery after a week or two.

The treatment of catarrhal jaundice consists in confinement to bed, restriction of the fats and milk-curd in the food; and the administration of rhubarb, bismuth, and soda. The bowels, if costive, should be kept moving by a mild saline laxative and occasional doses of calomel.

Cirrhosis of the Liver.

Multilobular cirrhosis from prolonged ingestion of alcoholic liquors or other unknown irritants is said to occur in children, but is certainly very rare. The symptoms are similar to those in the adult but usually are of shorter duration.

A *monolobular or biliary form* of the disease,[1] usually called "Hanot's Cirrhosis," which presents interesting peculiarities, is sometimes seen in older children. It is of unknown causation, and may occur in several members of a family.

The main clinical features are chronic jaundice lasting for years, with a uniform smooth enlargement of the liver and a very large spleen. Ascites is only found in the later stages. Repeated attacks of abdominal pain and tenderness with pyrexia and increased jaundice occur from time to time. Clubbing of the fingers often develops and, towards the end, there is a hæmorrhagic tendency. The disease may last for years without causing any noticeable cachexia; but the patients are apt to be undergrown and anæmic. No efficient treatment is known.

The *Intercellular Cirrhosis* caused by congenital syphilis is referred to elsewhere (p. 751).

Acute and "Subacute" Atrophy of the Liver.

Acute Atrophy of the Liver.—It is rare for acute liver atrophy of the ordinary classical type to occur in childhood. I have only seen two instances of this. Such cases may, however, occur at any age from early infancy onwards and

[1] Hanot, *La cirrhose hypertrophique avec ictère chronique*, Paris, 1892 James Finlayson, *Glasg. Hosp. Rep.*, 1899, 39.

they run the same rapidly fatal course as in adults, generally ending fatally within a week, or at most two, from the first appearance of the jaundice. The early symptoms resemble those of ordinary catarrhal jaundice and give rise to no anxiety. After a few days, however, the child becomes rapidly worse. The jaundice deepens, and vomiting occurs or, if previously present, assumes a more severe type, and blood may appear in the vomited matters and in the stools. Cerebral symptoms —delirium, drowsiness, and convulsions—soon set in and death follows in a state of coma. Subcutaneous hæmorrhages and epistaxis are common. The liver-dullness rapidly diminishes. The urine is scanty and deeply bile-stained, and it may contain albumin; on evaporation, it shows a copious deposit of leucin and tyrosin crystals.

While this is the course taken in the most acute cases, a large majority of those which begin somewhat in this way assume a less severe type—the so-called "subacute atrophy"—and gradual recovery takes place (*v. infra*).

The only *treatment* which can be used with any hope of relieving the patient's condition is the administration of repeated subcutaneous injections of normal saline solution. This has been found by H. Morley Fletcher[1] to cause decided improvement in the cerebral symptoms, and should always be tried. It probably acts by aiding the elimination of toxic substances.

Subacute Atrophy of the Liver.—The term "Subacute Liver-Atrophy" has been applied to a type of case which would be more accurately described as "Recurrent Partial Acute Atrophy of the Liver." The morbid process which occurs in it is not really subacute in the ordinary sense. It consists in a recurrent acute destruction of tissue which differs from what takes place in the acute liver-atrophy merely in the fact that it affects severely only certain scattered areas of the liver-tissue, and so much escapes destruction that the organ is able to carry on its functions and a partial recovery results. It is possible that when the proportion of the liver-tissue destroyed is small, permanent recovery may occur. In most cases, however, there is a speedy, and in time a fatal, recurrence of the disease.

[1] Garrod, Batten, and Thursfield's *Diseases of Children*, London, 1913, 210.

This type of liver-atrophy is especially characteristic of childhood, probably owing to the more vigorous resistance which the child's tissues offer to the disease and to their greater power of regeneration. During the last twelve years I have met with nine cases of this kind, five of which were examined post-mortem; and it seems probable that the condition is commoner than was formerly thought. Certainly many fatal cases of jaundice have been diagnosed as hepatic cirrhosis from other causes which were really instances of this disease. No definite line of distinction can be drawn between the milder cases of acute, and the severer instances of subacute atrophy as the difference depends solely on the extent to which the liver-tissue is involved.

It is not necessary to discuss here the very obscure subject of the pathology of acute liver-atrophy or its microscopical anatomy. It will be sufficient to say that the characteristic necrosis of the cells occurs in a partial and patchy manner throughout the organ and varies greatly in amount; and that the place of the destroyed cells is rapidly taken by fibrous tissue, while the liver endeavours to make good its loss of tissue by very active hyperplasia of those areas which have escaped destruction.

The naked-eye appearance of the liver is striking. Owing to the shrinking of the affected areas, and the bulging of those which have escaped and are undergoing hypertrophy, the surface is exceedingly irregular and nodular. The nodules vary in size and are of a bright green or a yellow colour, the intervening shrunken areas being reddish brown or pinkish grey.

Microscopic sections of the nodules show extremely hyperplastic liver cells, which often contain two or more nuclei, and many smaller cells which are evidently newly formed. The reddish shrunken tissue between the nodules contains no proper liver-cells, but is made up mainly of young cellular newly-formed fibrous tissue and blood vessels, and has a number of "bile-duct-like" structures ramifying through it.

Symptoms.—The clinical manifestations of "subacute liver-atrophy" vary considerably in different cases. The main symptoms which were present in my cases may be summarised as follows:—

The *onset* of the jaundice and the severe nervous symptoms

were usually preceded by headache, vomiting, and loss of appetite for a varying number of days; and these often continued after it appeared. In two of the cases there was diarrhœa also at the beginning of the illness. The *duration* of the attack varied greatly. It lasted generally for at least two to eight weeks, but in two of the cases the jaundice had persisted for five months at the time the child was first seen. The *number* of attacks also varied. In two cases (both of which were subjected to post-mortem examination) the patient died in the first attack. In the remainder it was the second, third, or fourth attack which proved fatal.

Jaundice is generally, but not invariably present. In two of the cases there had been two previous attacks in which there was jaundice, but this symptom was entirely absent in the third. In both of them, however, all the other chief symptoms were present, including severe pain in the right hypochondrium, fever, drowsiness passing on to unconsciousness, and ascites; and in one, which was examined post-mortem, the condition of the liver was typical.

Fever was present in four of the cases (102° to 104°), and absent in the other five. *Restlessness*, *delirium*, and increasing *unconsciousness* were prominent symptoms in five of the children, and two of them had blowing stertorous breathing not unlike that in uræmia. A *tendency to hæmorrhage* showed itself in three cases. In one there was epistaxis, in another bleeding from the gums, and in the third subcutaneous ecchymoses. *Severe abdominal pain*, generally in the right hypochondrium, was complained of in at least five of the nine cases. A considerable degree of *ascites* was present in three of them.

The *liver* was enlarged (from 1 to 4 f.b.) in seven of the cases. In the other two it was normal or slightly diminished in size. The *spleen* was more or less greatly enlarged in five, and normal in size in the others.

The *stools*, in all, were either very pale yellow or colourless. The *urine* was bile-stained. In two instances it contained albumin. In none of the cases was leucin or tyrosin discovered on evaporation.

Treatment.—This type of disease is no more amenable to treatment than the very acute variety; but the administration of subcutaneous injections of saline solution should certainly be tried.

Gall-Stones.

Gall-stones are very rare in childhood.[1] In most of the published cases they occurred in young infants and consisted of comparatively soft masses of inspissated bile. In some instances, their formation seems to be merely an incident in the course of congenital obliteration of the bile-ducts.[2]

Malignant Tumours of the Liver.

Malignant growths in the liver in young children are usually sarcomatous in nature; they are not at all common. The most striking symptoms are the extremely rapid growth of the liver, which in some cases can be noticed to enlarge from day to day, attacks of severe pain in the hepatic region, and irregular rises of temperature, along with no apparent cachexia and no obvious interference with the general nutrition. Usually there is neither jaundice nor ascites, and the spleen is not enlarged. The disease is rapidly fatal.

Simple Hepatic Cysts.

A large single cyst of the liver is occasionally, though rarely, met with. It projects downwards from the lower aspect of the organ and is apt to be mistaken for a right hydronephrosis. The treatment consists in incision and drainage; and the prognosis is good.

Hydatid Cysts of the Liver.

Hydatid disease of the liver is almost unknown in Scotland; but cases are sometimes seen in older children from Orkney or Shetland. The symptoms, diagnosis, and treatment are the same as in later life.

[1] Mercat, *De la colique hépatique chez l'enfant*, Thèse de Paris, 1884; Gourdin Servenière, *De la lithiase biliaire dans l'enfance*, Thèse de Paris, 1889; Still, *Trans. Path. Soc. Lond.*, 1899, l., 151; Stoeltzner, *Med. Klinik*, 1909, No. 1, 1.

Thomson, *Edin. Hosp. Rep.*, 1898, v. 1.

Fatty Liver.

Fatty infiltration of the liver is very common in early life, and is responsible for a considerable proportion of the enlarged livers found in little children. On clinical examination the fatty liver often feels so hard that it is thought to be either cirrhotic or amyloid.

Fatty degeneration of the liver is also common. It is seen in its most extreme degree in delayed chloroform poisoning and other forms of acid intoxication.

CHAPTER XVI

ON THE SKIN[1]

THE condition of the skin as to colour, moisture, and texture, as well as temperature, should be carefully noted, and the presence of any œdema, desquamation, eruption, or other abnormality investigated.

Colour.

Jaundice.—The various causes and varieties of jaundice have been considered in the last chapter.

Cyanosis.—General cyanosis may be a sign of disease of the heart or lungs, either congenital or acquired. When it occurs in an acute illness, it is usually of importance as indicating heart failure or serious pulmonary disease. Obscure recurrent attacks of blueness in an infant may, in rare instances, be due to abnormalities outside the heart, such as diaphragmatic hernia (p. 690). Cyanosis may also be present in diseases characterised by extreme prostration, such as septicæmia and malignant cases of infectious disease. Lividity of the extremities is frequent in all kinds of wasting diseases, and is especially marked in Raynaud's disease (p. 485).

Pallor.—The peculiar pallid brownish-yellow tinge of the skin which is characteristic of splenic disease sometimes occurs distinctly in children, especially if they have been much in the open air; but it is entirely absent in many cases in which the spleen is much enlarged. The sallow earthy tint of some scorbutic infants is a help in diagnosing the condition; and the same may be said in the case of syphilitic babies.

Pigmentation.—Addison's disease is very rare in children; but a brown discoloration, especially marked about the axillæ,

[1] The author has to thank Dr R. Cranston Low for very helpful criticism on this Chapter.

groins, abdomen, and perineum, is common in chorea and other diseases when arsenic has been given in large doses for some time. Leonard Guthrie pointed out that pigmentation of the skin is "a most important diagnostic sign of interstitial nephritis in both old and young, although not existing invariably."[1]

Patchy pigmentation of the skin may occur as an isolated phenomenon, and sometimes it is a symptom of a general disease, as in the case of the *café au lait* spots found in von Recklinghausen's disease (generalised neuro-fibromatosis).

An interesting form of congenital pigmentation of the skin is the so-called "**Mongolian Blue Spot**" in the sacral region or elsewhere on the back, which is found in 90 per cent. of Japanese babies at birth. These spots are said to be frequently present in all the dark races. C. Herrman[2] found them in 25 per cent. of negro infants, and also in 1 in 400 of white babies. The spots gradually fade as the child grows, and are invisible in a few years.

Nævoid Patches.—A reddish patch on the back of the child's neck about where the hair begins is not very rarely complained of by mothers. It is due to a nævoid enlargement of superficial veins, and is often so faint that it is entirely overlooked until the patient, if a girl, begins to "put up her hair." It is not amenable to treatment.

Reticular Mottling of the Skin (*Livedo Annularis or Cutis Marmorata*).—The peculiar mottled appearance which exposure to cold brings out in many normal skins is commoner and more distinct in childhood than in adult life, and ill-nourished children with languid circulation are especially apt to show it. The condition may up to a certain point be regarded as physiological; it owes its pattern to the distribution of the deep venous plexus. In some morbid states, such as scrofula, syphilis, rheumatism, myxœdema, and especially mongolism, it is often present to an unusual degree. In those who are predisposed to it there is sometimes a tendency for other skin eruptions such as those of measles, syphilis, and tuberculosis, to take on a marbled pattern of this kind to some extent.[3]

A brownish "measling" of the skin with the same marbled

[1] *Lancet*, 27th Feb. 1897, i., 587.
[2] *Journ. of Cutan. Dis.*, May 1907, 201.
[3] H. G. Adamson, *Brit. Journ. of Dermat.*, 1916, xxviii., Nos. 10-12, 281.

appearance is sometimes seen, and generally, though perhaps not always, results from intermittent exposure to strong dry heat. In it the mottling is persistent and pigmented, and does not disappear on pressure, owing to exudation having taken place from the blood-vessels. The presence of this eruption may occasionally be helpful in practice. For example, in children with various cachectic conditions, we find it, not very rarely, on the shins and on the inner side of the knees and thighs (Figs. 85 and 111). Its presence usually shows that the child

FIG. 85.—Reticular Mottling of the Skin.

has been in the habit of crouching closely over a fire to relieve a distressing feeling of chilliness. When a similar condition is met with in other parts of the body, it may indicate the position of a very severe pain which has been made bearable by the use of hot bottles or some other form of dry heat.

Lineæ Albicantes.—In rare cases a series of parallel, horizontal, atrophic lines are found crossing the skin of the knees and thighs,[1] which closely resemble the striæ gravidarum so often found on the abdomen during pregnancy. Like these

[1] Henoch, *Lect. on Children's Dis.*, 4th edit., New Syd. Soc. Transl., 1889, ii., 348.

they are at first pink in colour, but become white in course of time. There is almost always a history of an attack of typhoid fever having preceded their appearance. They are apparently due to stretching of the skin from the very rapid growth of the bones which often takes place in that disease. Similar striæ are sometimes found on the breasts of young girls.

Moisture and Dryness.

Profuse perspiration does not suggest the presence of phthisis in children so much as it does in young adults. In infancy, it is generally due to rickets, although it also occurs sometimes in empyema, in various forms of tuberculosis, and in toxæmia generally. In older children it is most frequently a symptom of intestinal indigestion with nervous exhaustion, and it calls for a thorough regulation of the diet and for general tonic measures, such as more fresh air and cold douching. Small doses of oxide of zinc (1 to 2 grs.) are sometimes also useful.

Texture.

The skin in healthy children is remarkably soft, elastic, and pliable. These characteristics are, of course, interfered with by such congenital conditions as ichthyosis; but if the skin of a sick child has been originally of normal texture, and has only recently lost its softness and resiliency, this should always be noted, as it is sometimes an omen of serious clinical significance.

This condition of skin is met with in cases of digestive disorder when the vital powers are being dangerously strained; and its presence may often draw our attention to the real nature of obscure cases of tuberculosis which, from the other symptoms, might seem not to be serious. A dry, harsh condition of the skin is also met with in diabetes and in older cases of untreated cretinism and of mongolism.

Ichthyosis.—Slight cases of ichthyosis in which there is dryness and thickening of the epidermic layer of the skin are of common occurrence. The condition is always congenital, and often also hereditary in origin, but generally it does not show itself for some weeks or months after birth. In rare instances, it is noticed from the first. The curious deformity

known as the "Harlequin Fœtus" is regarded as representing an extreme degree of this disease.

The treatment of all the forms of ichthyosis consists in removing the scales by alkaline and bran baths, and using habitually some form of fatty ointment. Kaposi recommended a 5 per cent. ointment of β-naphthol along with naphthol soap. If such measures are diligently employed, they greatly improve the state of the skin and the patient's comfort for the time; but whenever they are discontinued, the condition becomes as bad as ever.

Tylosis (*Hyperkeratosis*) **Palmæ et Plantæ.**—This is a rare family disease which shows itself in early childhood and affects both sexes equally.[1] It consists in a great thickening of the horny layer of the skin on the palms and soles, which is sometimes associated with hyperidrosis of these parts. At certain times of the year this thickened epidermis peels off, leaving the underlying skin red and very tender.

The treatment consists in removing the thickened epidermis by means of starch poultices and soaking with carbonate of soda, and in the local application of salicylic acid either as a 3 per cent. plaster or in the form of an ointment (½ drm. to 1 oz.) combined with ichthyol (1 drm.). If this line of treatment is persistently carried out, the disease can be kept in check to a large extent; but the condition relapses rapidly whenever it is neglected even for a short time.

Desquamation.

Any peeling of the skin is worthy of attention. If its distribution is bilateral or general, it suggests a suspicion of scarlet fever; but it not infrequently occurs in other diseases, such as rubella and typhoid, and after some toxic and drug rashes. In hospital patients, it may perhaps sometimes be favoured by the application of soap and water to an unwonted extent. In children suffering from prolonged feverish ailments, such as tuberculous affections of the mesenteric and bronchial glands, we often find a branny desquamation of the epidermis (pityriasis tabescentium).

Desquamation limited to the chest is often caused by rubefacient applications and poultices. In infants of a few

[1] Lewis Thatcher, *Edin. Med. Journ.*, April 1912, N.S., viii., 342.

months, scaling of the palms and soles is generally due to congenital syphilis, and is an important symptom of that disease. Erysipelas, also, is generally followed by profuse desquamation.

Œdema.

Although most forms of œdema of the skin are only part of a general dropsy, the subject of œdema may conveniently be considered in this chapter. It may either be localised or more or less general in distribution.

Localised Œdema may occur (*a*) from *lymphatic obstruction*, after an attack of erysipelas or in connection with various other forms of inflammation of the skin or deeper parts. It may also be due to (*b*) temporary or permanent *obstruction in large veins*. For example, slight œdema of the eyelids is characteristic of severe whooping-cough; in infantile scurvy, dropsy of the eyelids and of the limbs is a commoner occurrence; and local swelling of this kind in the hands and feet is seen in severe cases of infantile tetany, and sometimes in purpura.

Another variety is (*c*) *angioneurotic œdema*, including that often seen with severe urticaria. This sort of localised dropsy has been attributed to nervous action, but it is more probably produced by an anaphylactic process (see Appendix C) and by a direct effect of the abnormal fluids on the muscle fibres or blood-vessels. Angioneurotic œdema is sometimes an alarming condition. Acute swelling of the cheek, hand, scrotum, or some other part of the body appears suddenly and passes off again rapidly, often in the course of an hour or two. Although there is generally no danger connected with it, there is always a possibility of the swelling extending to the fauces and giving rise to fatal œdema glottidis. This, however, very rarely happens. When the dropsy affects one of the lower limbs in an infant it may simulate infantile scurvy. No satisfactory treatment of the disease is known.

Generalised Œdema may be set up in various ways. It may be caused (*a*) by *general venous obstruction* from heart-failure (cardiac œdema). This shows itself mainly in the most dependent parts. It occurs much less commonly in children than in adults, and is only seen in them in the later stages of acquired heart disease. Œdema also occurs (*b*) in *anæmia and cachexia* from hydræmic plethora. This form of it also

affects dependent parts chiefly. (*c*) Œdema is, of course, a common symptom in *kidney disease*, especially in acute primary and in chronic parenchymatous nephritis; and whenever, dropsy is present, the urine must be carefully examined. Occasionally, in cases of acute nephritis, severe dropsy may set in before albuminuria has begun. In renal dropsy the distribution of the swelling depends more on the local laxity of the tissues than on gravity.

One of the commonest and most interesting forms of œdema in young infants is that seen in (*d*) *defective excretion of salts* from the body. As already mentioned (p. 114), an excess of salt (and also of sugar) in a young infant's diet is apt, even in health and still more during sickness, to lead to a gain in weight from increased retention of fluid in the tissues. The retention of salt is not due to any defect on the part of the kidneys, which continue to excrete phosphates, urea, and other substances in the usual way. This kind of dropsy may be only temporary, but it usually takes several days before diuresis is sufficiently established to get rid of the extra salt. In most of the cases there is no noticeable superficial œdema, but, in new-born and premature infants, the condition may go on to obvious dropsy of the skin; and, the younger the child, the longer does the swelling take to disappear. It sometimes occurs when beef-tea or bouillon is given to a weakly baby who is being fed on a weak milk mixture or on breast milk. In the course of "decomposition" (p. 190) a severe degree of œdema is especially apt to take place, and a slight amount of it is so characteristic that its occurrence, without apparent cause, should lead us to suspect the presence of that condition. It is also not uncommon in babies of a few weeks who are being simply overfed.

The management of this form of œdema consists in the thorough dietetic treatment of the nutritional disturbance (Chapter IX.), and not in the mere withholding of salt, as is indicated in renal dropsy. When the food is properly regulated the œdema disappears; and, naturally, the less salt and sugar there is in it, the more rapidly does recovery take place. When the treatment is begun, a rapid loss of weight is to be expected. Any attempt to lessen the œdema in such cases by the administration of diaphoretics, diuretics, or heart tonics is harmful as well as useless.

When œdema occurs in the course of chronic diarrhœa in young children, the hypodermic administration of adrenalin solution in doses of 5 minims twice daily seems often to accelerate the disappearance of the swelling.[1]

Œdema Neonatorum.—When a baby is born œdematous, or becomes so immediately after birth, this may be due to congenital nephritis. The majority of slight cases of congenital dropsy, however, depend on other causes; such a condition usually indicates a dangerous degree of weakness.

Sclerema Neonatorum.

True sclerema neonatorum is a rare disease, met with almost exclusively in continental maternity and foundling hospitals. The children may seem normal when born, but are usually very feeble and often premature. Within a day or two of birth, they begin to waste, the temperature falls to below 90° F.—sometimes as low as 84° F. or even 78° F. —in the rectum, and the skin becomes thickened and hard. Beginning in the lower limbs, the induration spreads over the trunk, arms, and face, and the whole body may become stiff with it. The surface is of a pale dirty yellow colour, and cold like that of a dead body; the extremities are cyanosed; the thickened parts do not pit on pressure. Death almost always takes place in three or four days, or within three or four weeks at latest.

Pseudo-Sclerema.

The term "pseudo-sclerema" may be applied to a class of cases which is not very uncommon in this country, and which is often mistaken for true sclerema. It resembles the latter in the large indurated areas of skin and subcutaneous tissue which it causes in the same parts of the body, though its distribution is generally less extensive.

The affected areas of skin are of a purplish-red colour, apparently painless, very much thickened and quite hard, so that they do not pit at all on pressure. The temperature varies from a little below to a little above normal; but there is no tendency to the extreme subnormal temperature which

[1] W. E. Hume, *Brit. Med. Journ.*, 1911, ii., 478.

is characteristic of true sclerema, and no collapse. The children usually recover, under treatment, but it is often several months before all induration has gone. Those cases which I have seen recover were treated by inunction with either mercurial or ichthyol ointment along with careful attention to the general health. There seems to be no reason to regard the condition as of the same nature as real sclerema. The distribution and character of the lesion and its usual clinical course seem to indicate that it represents an infantile form of the *diffuse symmetrical scleroderma* which is met with in rare instances in older children.[1]

FIG. 86.—Subcutaneous Emphysema, following severe coughing.

Subcutaneous Emphysema.[2]

In young children subcutaneous emphysema sometimes occurs in the neck and neighbouring parts, as a consequence of violent coughing (Fig. 86). It may or may not be accompanied by pneumothorax. The air is driven upwards from the mediastinum by the cough, and finds its way into the subcutaneous tissues of the neck, face, scalp, and sometimes further. It usually occurs in cases of measles, whooping-cough, and bronchitis, and it is generally recovered from, unless the original condition is serious. When recovery takes place, the air is absorbed in from three to seven days. The main treatment consists in soothing the cough.

[1] H. Radcliffe Crocker, *Diseases of the Skin*, 2nd edit., 1893, 371.

[2] L. Guillemot, *Grancher and Comby's Traité des Maladies de l'Enfance*, 2nd edit., iii., 498; Huber and Hirsch, *Arch. of Ped.*, March 1910, xxvii., 191.

Another cause of subcutaneous emphysema is the puncture, with a large exploring needle, of a lung which is adherent to the chest-wall. Unless local pressure is applied at the time, the air may spread considerably. This sometimes gives rise to a slight rise of temperature (about 101° F.) for two or three days, but it need cause no anxiety.

Eruptions.

Skin eruptions are to be investigated as to their distribution, the presence of itchiness, the anatomical character of the lesions, and their apparent cause.

Distribution.—The precise position and extent of the rash are the first points to be ascertained; and this may throw much light on its cause. In early infancy, the palms and soles are favourite sites for the lesions of congenital syphilis and scabies. Eczema is met with mostly on the face, and never on the napkin area; while the latter region is the favourite site for erythema from the irritation of ammoniacal urine, streptococcal eruptions, seborrhœic dermatitis, and specific eruptions. The napkins irritate the convex areas of the skin which are in contact with them, and spare the flexures. The syphilitic rashes usually affect the convex surfaces and the flexures equally. Other peculiarities in the distribution of specific rashes will be referred to later (Chapter XXXVI.).

Itchiness.—A common and distressing symptom is itchiness, which occurs especially in urticaria, prurigo, eczema, scabies, dermatitis herpetiformis, and pediculosis, sometimes also in the early stages of measles and scarlet fever, and in varicella. It is never present in syphilitic rashes.

Character of the Lesions.—In infancy, according to Radcliffe Crocker, skin eruptions "are more likely to take a pustular form and, from the ease with which the alimentary canal is deranged, there is greater tendency to eczema or urticaria." Rutherford Morison has drawn attention to the fact that cellulitis is almost unknown in early childhood. It is important to remember this, because cases of acute osteomyelitis are sometimes mistaken at first for cellulitis, and the necessary operation deferred with disastrous results.

Causation.—In considering the causation of any extensive eruption in a young baby, the possibility of congenital syphilis, scabies, and drug eruptions should never be forgotten. The effect in exciting and aggravating skin disease exerted by scratching, excessive perspiration, washing with strongly alkaline soaps, imperfect drying of the skin after bathing, and exposure to strong winds, must also be remembered. The influence of teething on eczematous eruptions has been already discussed (p. 40). Vaccination, although often unjustly blamed, certainly does occasionally act as an exciting cause of skin-eruptions, and generally tends to aggravate them if present; in rare cases, however, it may have a beneficial effect upon a very chronic eczema. The influence of general toxic conditions of all kinds in causing skin-eruptions is always to be borne in mind.

Eczema.

The term "eczema" is much more limited in its application than it used to be; and seborrhœa, impetigo, and other conditions which were formerly included under it are now generally regarded as distinct diseases. It is defined by Adamson as "a catarrhal inflammation of the skin of non-bacterial origin, the chief factors in the production of which are probably local external irritation and some unknown toxic or metabolic influence acting as a predisposing cause."

Causation.—There are then two sets of etiological factors at work, or which may at any time be at work, in causing eczema. There are *local exciting* causes such as scratching, dirt, excessive perspiration, the use of strong soaps, and exposure to strong dry winds. These rapidly bring out the eruption on some skins, although in most children they have no such effect; and even in the same patients do not always do so. Then, there are *general predisposing* causes which are often equally important from the point of view of treatment. The predisposing toxic and metabolic causes are still, in many cases, obscure; but information about them is gradually accumulating. We have already seen how strong an influence teething has in starting and prolonging eczema in some cases, and how vaccination and other acute ailments may also predispose to it; but what is of more importance is the strong

temporary predisposition sometimes set up by curable digestive disturbances.[1] Thus, there is a form of acute exudative eczema in thriving breast-fed babies who are gaining weight rapidly, which is caused simply by excessive feeding, and only needs restriction of the breast milk for its cure. Similarly, in bottle-fed babies and older children, examination of the stools, and diminution of those elements of the food which are found not to be properly digested, may cause rapid improvement and disappearance of the eruption. The elements which are mostly to blame in these cases are fats and starches. The fact, that local and general causes which evidently produce eczema in some children do not do so in others, seems, however, to indicate that some further predisposing influence exists. This may sometimes consist in a congenitally defective formation of the skin, but it probably depends more frequently on a constitutional abnormality.

There can be no doubt that infantile eczema is sometimes, like urticaria and erythema, to be regarded as a clinical manifestation of modified anaphylaxis (Appendix C); and, as Schloss,[2] Hoobler,[3] and others have shown, it is certainly sometimes set up by the absorption of some unaltered protein, such as egg-albumin, from the alimentary canal. A large number of children who have eczema in early infancy develop asthmatic symptoms later; and more than a quarter of the children with asthma I have treated had previously suffered from eczema (p. 521). It is also interesting to note that infantile eczema often runs in families, and that it is not uncommon to find a history of gout, eczema, asthma, hay-fever, and idiosyncrasies to common forms of food, among the patient's near relatives.

Distribution.—In infants, eczema usually begins on the face and spreads there till it involves the convex surfaces of the forehead, cheeks, and chin—the parts, that is to say, which are most exposed to friction. In many cases it does not go beyond the face; but in others it extends over the scalp and behind the ears, and it may also involve the trunk

[1] Harvey P. Towle and Fritz B. Talbot, *Amer. Journ. Dis. Child.*, October 1912, x., 219; Rowland G. Freeman, *Arch. of Ped.*, 1914, xxxi., No. 10, 735.

[2] *Amer. Journ. Dis. Child.*, 1912, iii., 341.

[3] *Ibid.*, 1916, viii., 129.

and limbs to a greater or less extent. In the chronic relapsing eczema of older children, the flexures of the elbows, knees, and wrists are especially apt to be implicated.

Prognosis.—The chances of recovery are generally good. Most cases can be much improved, and many cured, by a few weeks of careful external and internal treatment; though the disease is apt to recur. It is important to remember that this tendency of the eruption to return passes off, in the majority of cases, when the process of dentition is complete (p. 40).

In all cases in which a large part of the body-surface is covered for a long time by an eczematous eruption, we must bear in mind the risk there is of septic contamination, and also the danger which will arise should the kidneys become affected while the skin is in such a state. Cases are occasionally reported in which children with extensive eczema die suddenly with high temperature and convulsions. The explanation of these cases is still obscure.

Treatment, General.—In treating a case of infantile eczema, the first thing to do is to revise the diet, and to see to it that the child is not being overfed and is having plenty of fluid. We may then ascertain, by inspecting his stools, that he is not having more fat or carbohydrate than he is able to digest. If constipation exists, it should be relieved by the regular use of Carlsbad salts or in some other way; and diarrhœa, if present, should be *gradually* checked.

Generally, internal medication is not indicated; but if the child is anæmic or rickety, iron or cod-liver oil may be useful. If he shows signs of lithæmia, the addition of citrate of soda to the milk, or giving small doses of salol and sodium bicarbonate, is often very beneficial. Arsenic is rarely of any use, and generally aggravates the inflammation in acute cases. In these, small doses of antimonial wine (1 to 2 minims) are sometimes recommended. In a few very chronic eczemas the administration of thyroid has a good effect.

Bromides are of little value in relieving the itching of eczema. The most useful drug for this purpose is antipyrine (1 to 2 grs. in babies); and it is sometimes well to secure an occasional good night by giving a full dose of chloral. The essential point in the treatment of the itching, however, when the free application of ointment does not relieve it,

is to secure the child's hands by tying them to the bed, or by applying arm-splints in such a way that scratching is made impossible.

Local.—The first point in the local treatment of the condition is to protect the diseased skin from irritating influences. The child must be carefully kept out of strong winds. High bracing places will generally be found bad for him. Washing with irritating strongly alkaline soap should be forbidden. The affected parts must, of course, be kept clean, but the bath should be of short duration and carefully given, and oatmeal or bran and water, or normal saline solution is better than plain water. When some soap is found necessary, an over-fatty variety should be chosen. After drying, zinc and starch or some other simple dusting powder is sometimes useful. If ointment is used, it should be spread preferably on old linen, and bandaged on. When the eczema is on the face the ointment should be applied on a mask (Fig. 87).

FIG. 87. –Mask for Facial Eczema.

The best local application to select depends on the state of the eruption. In cases with much crust-formation, it is always well to begin with starch and boracic poultices, which soften the scabs, so that they can be easily removed, and lessen the inflammation. Later, a calamine lotion (Appendix I, Form. 22) is often useful. Lassar's paste and white precipitate ointment (5 grs. to 1 oz.), with or without the addition of zinc oxide (1 drm. to 1 oz.), are favourite applications. Very acute cases are often benefited by the addition of ichthyol to the ointment (20 grs. to 1 oz.). Eczema behind the ears generally recovers rapidly with an ointment of bismuth and zinc (ää 1 drm. to 1 oz.), or of tannic acid (1 drm. to 1 oz.). In seborrhœic eczema a small amount of sulphur (5 grs. to 1 oz.) should be added to the ointment. In chronic cases, when the skin is very dry, great relief may often be given by soaking with Carron or cod-liver oil.

When the itching is severe, the application of tar in some

form or other is generally indicated. It may be used as a lotion (liq. picis carbonis 1 drm. to 10 oz. of water), or as an ointment (ung. picis 1 drm., ung. zinci to 1 oz.). If any preparation of tar is being applied to a large surface of skin, a watch must be kept on the urine, as carboluria or albuminuria may be set up.

Erythema of the Napkin Area.

The region covered by the napkins is often the site of acute erythema set up by ammonia given off by the urine. The cause of this is discussed elsewhere (p. 374). The eruption is confined to the convex surfaces of the skin which are in contact with the diapers, and it spares the flexures. The calves and heels are sometimes also affected.

The *treatment* consists in the careful washing and frequent changing of the napkins. The affected skin should be repeatedly washed with warm water or saline solution, and vaseline or zinc ointment applied. In the more severe cases, an ichthyol ointment is useful. The child's digestion should be attended to.

Erythema Nodosum.

Symptoms.—Erythema nodosum is a common condition in childhood. Its well-known red, rounded, slightly raised and tender areas are generally met with on the shins only, although sometimes they occur on the extensor surface of the arms also, and to a much less extent on other parts. The eruption usually lasts for two or three weeks, but relapses sometimes occur. It is important to bear in mind that the eruption may be preceded and accompanied by a remittent temperature closely resembling that of early typhoid, with considerable disturbance of the general health. Occasionally "rheumatic" joint pains are complained of; hence the eruption was formerly regarded as a manifestation of rheumatism.

The etiology of the disease is still obscure[1]; and probably an eruption of this character may arise from various causes. In a few instances, the eruption occurs in undoubtedly tuberculous patients, and giant cells have sometimes been demonstrated in

[1] E. Bronson, *Brit. Journ. Child. Dis.*, April to June 1918, xv., 91.

its lesions. Similarly, cases occasionally occur in which there is active rheumatism with nodules and heart-lesions. In the very large majority of instances, however, there is no reason to believe that either tuberculosis or rheumatism is present, even although the joints are painful. It seems probable that the eruption is generally a symptom of a special specific disease which has been called "*nodal fever*." The joint pains are probably due to an inflammatory œdema of the articular structures of a toxic nature, similar to that which occurs in serum disease, and not to direct bacterial action.[1]

The *treatment*, in severe cases, consists in confinement to bed, milk diet, saline laxatives, salicylate of soda or aspirin if there are any joint symptoms, and lead and opium lotion if the eruption is painful.

Erythema Pernio (*Chilblains*).

Chilblains are common, in cold damp weather, in delicate children, and also in many who do not seem delicate apart from their sluggish circulation. Bluish red patches appear on the toes, heels, and margins of the soles, on the fingers and ears, and sometimes, in babies, on the cheeks. The patches are tender and cause severe itching and burning, especially when the parts are warm. In neglected cases, and when there is pressure from badly fitting boots, the chilblains are apt to break and extensive ulceration may occur.

Preventive *treatment* is important as, once the chilblains have formed, remedies are only partially successful. Children who are subject to the complaint should be encouraged to take much active exercise in the open air, and to accustom themselves to sleep with open windows. The habit of warming the feet and hands at the fire should be avoided as it is particularly harmful. Modified cold douching is useful. Strong *roomy* boots with warm stockings are essential. The general health must be attended to, and there are several medicines which are sometimes useful. Calcium lactate (5 to 10 grs. every four hours for several days) is probably that which is most often successful. Cod-liver oil is also indicated, and small doses of liquor arsenicalis are said to have a distinctly prophylactic effect. Small doses of thyroid (1 gr. twice daily) should be tried

[1] A. E. Garrod, *Lancet*, 27th May 1911, i., 1411.

in obstinate cases. In girls of low intellectual capacity, about the time of puberty, this treatment is specially indicated as in them a temporary degree of hypothyroidism is not uncommon.

When the chilblains are unbroken, tincture of iodine may be painted on once daily, or a weak capsicum ointment (capsici ½ drm., ol. amygd. 2 drms., lanolini 6 drms.) rubbed in. When the skin is broken, boric or zinc ointment, alone or with a drachm to the ounce of ichthyol or of resin ointment added, may be used. The application of a Bier's bandage round the wrist or ankle for a few minutes once a day is also sometimes beneficial.

Enema Rash.

The administration of a rectal injection occasionally causes a rash. It consists of slightly raised bright red patches of erythema which are small and rounded at first but afterwards run into blotches. It is commonest in children between six and twelve years old.

The distribution of the eruption tends to be symmetrical and is characteristic.[1] It is found on the body, on the extensor surface of the elbows and knees, on the buttocks, and on the face—especially the cheeks and chin. It is never seen on the palms and soles. Occasionally it is preceded by a diffuse scarlatiniform rash which affects the face as well as the body. It is accompanied by little or no itching. The interval between the administration of the enema and the onset of the eruption varies from two and a half to forty-eight hours (usually twelve to twenty-four), and the rash remains visible from twelve to seventy-two hours (usually twenty-four to forty-eight). There is no constitutional disturbance, no rise of temperature, and no enlargement of glands. There is generally no desquamation, but this does occasionally occur. The rash is most apt to appear after a first enema, and usually, though not always, soap has been used. A similar eruption sometimes follows a saline purge. No treatment is necessary.

Drug Eruptions.

Antipyrine Rash.—The rash which is produced in some children by antipyrine is generally seen first on the extensor surface of the elbows and knees and on the thighs and buttocks;

[1] G. F. Still, *Clin. Soc. Trans. Lond.*, 1899, xxxii., 11.

but it may be more widespread in some cases (Fig. 88). It is deep red in colour and papular or morbilliform in type, and in places the spots may run together into blotches. It is sometimes itchy. When such a rash is found, the urine should always be examined for albumin and tube-casts, as the drug is apt to cause an irritation of the kidneys which subsides on its being discontinued.

FIG. 88.—Antipyrine Rash.

Bromide Rashes. — In children who are specially susceptible, even small doses of bromide may produce an eruption on the body, face, or limbs. This is generally in the form of acne pustules, which may be discrete (Fig. 89) or confluent. In the latter type, which is that most frequently seen in babies, we have large rounded or oval raised red patches, the surface of which is studded with yellow spots which represent the centres of the individual acne spots. The rash is occasionally seen in breast babies whose mothers are taking bromide or have been doing so within a few weeks.

Iodide Rashes are much less common than those from bromide, but a discrete eruption of acne-like spots is sometimes met with in children who are taking iodide of iron or some other compound of iodine. Its appearance is sometimes accompanied by a rise of temperature.

Belladonna Rash.—A scarlatiniform rash is sometimes produced in susceptible children by belladonna. It may occur without any extreme dilatation of the pupils, and is unaccompanied by fever.

Serum Rashes.

The rash which sometimes follows the injection of serum may be a blotchy urticarial eruption, or an erythema, either of a multiform character or resembling that of measles or scarlet fever. The interval after which the rash appears varies greatly. According to C. B. Ker[1] the scarlatiniform type is generally seen between the second and sixth, and the urticarial variety between the eighth and eleventh days. The rash may, however, appear on any day during the first four weeks after the injection. It is often followed by desquamation.

Joint-pains and various other forms of uneasiness accompany the eruption in some cases; but, in most, the absence of

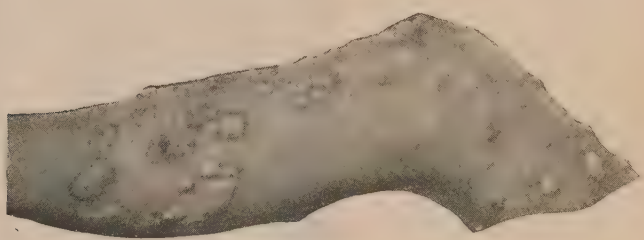


FIG. 89.—Bromide Acne in a child of 3 years.

constitutional symptoms is noticeable. There may be no rise of temperature.

No treatment is very efficacious in stopping the irritation of the urticarial rash. It may, however, be temporarily relieved by the free application of a carbolic calamine and zinc lotion (Appendix I, Form. 21); and the hypodermic injection of epinephrin (0·6 to 1 c.c.) at night is said to give great relief for a short time in some cases.[2]

Psoriasis.

It is rare for psoriasis to begin before the fourth or fifth year; and in childhood it generally appears first in the form of small round scattered spots. The fact of its having begun early in life does not necessarily mean that it will be sure to

[1] *Infectious Diseases*, London, 1909, 402.

[2] Avery, Chickering, Cole, and Dochez, *Monogr. of Rockefeller Inst. for Med. Res.*, 16th October 1917, No. 7, 1.

recur. If the treatment is sufficiently energetic and thorough from the first, it is very likely not to return. In children, as in adults, the key to successful treatment lies in thorough attention being given to the scalp; for it is there that relapses are apt to take their origin.

Urticaria.

Ordinary urticaria is often met with in childhood. It is usually connected with digestive disturbances, though the other symptoms of these may not be very prominent, and sometimes occurs simply from over-eating. It may, as in adults, be due to taking certain articles of diet, and is often associated with asthmatic symptoms (p. 521). Occasionally, it is met with during the active stage of rheumatism. Sometimes urticaria is accompanied by distinct œdema; and when this is so, the eruption may be very slight. In unexplained œdema, therefore, it is always well to inquire particularly as to the presence of itching. The form of urticaria which is peculiar to childhood is urticaria papulosa, and it is an extremely common affection.

Urticaria Papulosa (*Lichen urticatus*).

Symptoms.—This condition differs from ordinary urticaria in being a papular or papulo-vesicular affection. The papule begins as the centre of an urticarial wheal, but the wheal rapidly fades. The papule may be topped by a vesicle, and occasionally large bullæ form. The severity of the itching generally leads to the tops of many of the papules being scratched off and replaced by scabs. The eruption is also often complicated by a contagious impetigo spread by the scratching.

The eruption of lichen urticatus is met with chiefly on the extensor surface of the arms and legs, on the loins and buttocks, and on the wrists and hands. The upper part of the face, the genital organs, and the palms and soles are generally free.

The disease is commonest in the summer months and during the first two years of childhood, but it occurs frequently up to the eighth or tenth year. It often lasts for months in spite of all treatment, and it tends to recur. This tendency passes off, however, as the child grows older. It is often attributed to digestive disturbance, but it is generally

impossible to be sure that there is any real connection between the two conditions.

The *diagnosis* is generally easy. Occasionally, however, when it is complicated by impetigo and altered by much scratching, the eruption may resemble scabies; but the characteristic burrows are absent and the distribution of the eruption is quite different. The bullous variety of urticaria papulosa is apt to be mistaken for varicella.

Treatment.—This form of urticaria is usually a most obstinate and unsatisfactory malady to treat, as we are so ignorant of its exact causation. The main indications are as follows:—

1. Attend to the digestion and general health, avoid all indigestible articles of diet and sweets, and keep the bowels right with magnesia and an occasional dose of grey powder and rhubarb. Sometimes ichthyol in one or two minim doses with glycerine and syrup seems to do good.

2. General sedatives such as antipyrine are often useful in helping the child to sleep. In urticaria papulosa, as in chronic relapsing urticaria, large doses of quinine are sometimes useful. A grain and a half for each year of the child's age may be given at bedtime (Eustace Smith).

3. Local applications almost always give some relief, although often it is only slight and temporary. A $2\frac{1}{2}$ per cent. ointment of β-naphthol may be used or a calamine lotion (Appendix I, Form. 22). Tarry lotions are particularly soothing—*e.g.* glycerin. plumbi acetat., and liq. picis carbon. āā 2 drms. to 6 oz. water. They should be followed by dusting with starch powder.

Urticaria Pigmentosa (*Xanthelasmoidea*).

Urticaria pigmentosa is a rare disease, but is usually seen in early childhood. In a few cases the eruption has been present at birth, but generally it appears during the early weeks or months of life. Cases have been reported in which it only began in adult life.

The eruption is seen mostly on the trunk, neck, and thighs. Sometimes the spots are few in number, but usually they are thickly scattered over the skin in the affected areas. The eruption consists of rounded or oval spots of a peculiar

yellowish-brown colour which may be flat (maculæ) or slightly raised (papules); and it is characteristic of them that they swell and become itchy when exposed to the air or rubbed, and also when the child is excited. The general health is quite unaffected. The diagnosis, which is not difficult, depends on the age of appearance and the distribution of the eruption, its pigmentation, and especially its peculiar urticarial irritability.

The causation and nature of the malady are altogether obscure, but it is regarded now by dermatologists as quite a distinct disease from ordinary urticaria.

Spontaneous recovery takes place about the time of puberty, or soon after, in most cases; and until recently no *treatment* has been found to have any effect upon its continuance. Dr R. Cranston Low tells me, however, that he has seen great improvement follow the application of X-rays.

Staphylococcal Impetigo.

The form of impetigo caused by staphylococcus aureus differs from other varieties of this eruption in that its lesions occur in and around the hair-follicles, and are pustular from the first. It may be set up by dirty applications to the skin, and is a common complication of other skin diseases in children—such as scabies, lichen urticatus, impetigo contagiosa, and ringworm.

Treatment.—Impetigo usually yields rapidly to washing with a weak corrosive solution, boracic dressings, and incision of any boils that form. If the eruption is obstinate, or tends to recur vaccine treatment should be tried, and is often successful.

Impetigo Contagiosa.

Contagious impetigo is characterised by the formation of vesicles and bullæ which burst almost at once forming large yellow scabs. These crusts are much larger than those in eczema and there is no itching. When they are picked off, shallow excoriations are left. The disease is extremely common, especially on the face and head. It is due to streptococcal infection and is very contagious. In boys' schools it is rapidly spread by football and such games, and goes by the name of "*Scrum Pox.*" Among the poor it is generally

associated with the presence of *pediculi capitis*, and when these are found, the hair should always be carefully examined for nits. In delicate children, if neglected, it may give rise to severe cervical adenitis and even to abscess-formation.

Treatment.—The eruption is generally cured quickly by *careful removal of the crusts* by means of starch and boracic poultices, followed by washing with a weak solution of corrosive

FIG. 90.—Gangrenous Dermatitis.

(1 to 4000) and the application of dilute ammonio-chloride of mercury ointment (5 grs. to 1 oz.).

Ecthyma.

In badly nourished children streptococcal infection is apt to cause deeper skin ulceration and scabbing. It is then called ecthyma.

In this eruption the *treatment* of the child's general health is of great importance. The local treatment is the same as for ordinary impetigo.

Gangrenous Dermatitis (*Varicella Gangrenosa*).

This eruption used to be regarded as a sequel of varicella that was apt to occur in cachectic infants. This is now thought to have been a mistake due to its early lesions having a superficial resemblance to chicken-pox vesicles. The condition is mostly met with in young babies. Large rounded ulcerations form with a blackened base (Fig. 90), and these spread con-

siderably and run into one another. The patients are generally in an extremely exhausted state, and they rarely recover. The *treatment* consists in the use of stimulants and opiates in full doses and in local antiseptic measures. Adamson recommends prolonged soaking in a warm bath, followed by the application of lotio hydrarg. perchlor. (1 in 2000). He says that, under this treatment, the ulcers rapidly heal; and that, if it is carried out early, the child's life may be saved.[1]

Boils (*Furunculosis*).

This is generally a disease of cachectic infants, but by no means always. It is due to the action of staphylococcus aureus. The chief peculiarities of boils in infancy are their small size, their large number, and the absence of a core.

The *treatment* consists in general attention to the nutrition and digestion, including the administration of tonics. Sulphide of calcium ($\frac{1}{2}$ gr. four or five times a day) has been strongly recommended. Local treatment is important. The skin should be thoroughly purified with bichloride of mercury solution (1 in 2000). The boils should be incised when they point, their contents squeezed out, and iodoform powder applied. When this is done, they heal rapidly in most cases. Far the most effectual treatment, however, consists in the use of a staphylococcus aureus vaccine; and this should always be had recourse to if the case is at all obstinate.

Exfoliative Dermatitis of New-born Children (*Ritter's Disease*).

This is an obscure and very fatal disease of the skin which sets in, usually within the first week, or at any rate within the first two or three weeks, in apparently healthy children. The face and the "napkin area" are generally markedly affected, but the whole surface of the skin becomes implicated in time. Flaccid pemphigus-like bullæ occasionally appear and extend indefinitely. The adhesion of the epidermis to the underlying parts becomes so loosened that the least touch removes it and

[1] *Garrod, Batten, and Thursfield's Diseases of Children*, London, 1913, 1134.

leaves the red raw-looking corium exposed (Figs. 91 and 92). Fissures form about the mouth and anus. There is no rise of temperature, but the child's general strength is profoundly

FIG. 91.—Exfoliative Dermatitis in a child of 13 days.

affected and he usually dies within a week in a state of exhaustion. A few cases, however, recover.

The condition is believed to be due to a form of septic infection. It has certainly nothing to do with congenital syphilis, although it is often mistaken for a manifestation of that disease.

FIG. 92.—Exfoliative Dermatitis in a child of 13 days.

Treatment has generally no effect. Escherich recommends the application of linseed oil and lime water in the early stages and Lassar's paste and zinc powder later.

Seborrhœa.

Simple seborrhœa of the scalp in babies is an extremely common condition. It also occurs as dandriff in older children;

and, when severe, may be mistaken for ringworm. Its treatment consists in frequent and thorough washing with spirit of soap. In obstinate cases an ointment of sulphur and salicylic acid (āā 15 grs., vaseline 1 oz.) is useful. For the permanent cure of seborrhœic dermatitis on the face, or elsewhere on the body, it is *essential* to get the scalp into a thoroughly healthy condition.

Seborrhœic Dermatitis.

Seborrhœic dermatitis is one of the commonest eruptions in childhood. It is met with on the face and neck, behind the ears, in the groins, and on the napkin region in babies; and it is also common in older children on the chest, back, abdomen, and elsewhere in the form of rounded yellowish-red greasy patches like those so often seen in adults. It can usually be *treated* successfully by a weak ointment of sulphur and salicylic acid (āā 5 grs., vaseline 1 oz.).

Warts.

Ordinary warts are due to an unknown contagium. They come, and also often go, spontaneously in a mysterious way. If they grow from a small base, they should be snipped off with scissors and the base touched with a strong solution of chromic acid (ac. chromic. 1 drm., aq. 45 minims). If they are large, the chromic acid solution may be painted on them once every three days, the burned tissue being sliced off with a knife before each fresh application. Or, salicylic collodion (1 drm. to 1 oz.) may be applied once daily. When the warts are numerous, a few applications of the X-rays may be tried and will sometimes cause them to disappear rapidly.

Molluscum Contagiosum.

Molluscum contagiosum is a form of wart, due to an unknown infection, which is apt to spread from the common use of towels. When the lesions are few and pedunculated, they may be *treated* by being snipped off. What is even better, is to shell out their contents by squeezing between the thumb nails and then to rub carbolic acid thoroughly into their centre by means of a sharpened wooden match. If they are numerous and close together the X-rays may be used.

Herpes Zoster.

Herpes zoster is commoner between four and twelve, than at any other period of life (Head[1]). Its appearance is generally preceded by malaise and nocturnal restlessness, and sometimes by vomiting, and there may also be some rise in temperature; but often there are apparently no general symptoms at all. It is characteristic of the disease in childhood that there is little or no pain during the onset; and the occurrence of severe after-pain, which is such a distressing symptom in old people, never occurs in early life. The distribution of the eruption is the same as in adults except that the forehead is very rarely affected. Occasionally it is met with on the mastoid region along with an affection of the tonsil.

During the last few years attention has been repeatedly drawn to the interesting fact, that cases which present the typical characters of herpes zoster, sometimes infect other children with ordinary varicella.[2]

The *treatment* of herpes zoster consists in the application of zinc dusting powder and a layer of cotton-wool.

Herpes Simplex (*H. febrilis*).

Herpes febrilis, the eruption of groups of vesicles which so commonly occurs with an ordinary cold, is seen often in pneumonia, cerebro-spinal meningitis, and various other febrile conditions. It is common on the lips, cheeks, and ears. Unlike herpes zoster, it has a strong tendency to recur in the same positions. It is said that "an attack may sometimes be aborted by a few grains of quinine, taken on its first appearance, or by rubbing on a strong sulphur ointment, or by painting on collodion. When the vesicles have formed, calamine lotion or zinc ointment may be applied."

Scabies.

The peculiar distribution and the tendency to rapid suppuration of the lesions of scabies in infants lead to its real nature being often overlooked. Scabies does not occur on the face

[1] *Allbutt and Rolleston's Syst. of Med.*, London, 1910, vii., 470.

[2] Claude B. Ker, *Lancet*, 14th August 1920, ii., 347.

in adults, but the baby's cheeks are apt to be infected from the mother's breasts. In the same way, the mother's fingers are more likely to infect the baby's feet than his hands. The violent way in which the child's delicate skin reacts to the presence of the parasite and to the scratching it sets up, causes such severe pustulation that it is very difficult in most cases to make out the characteristic burrows—not to speak of finding the acarus. There is invariably, however, violent itching—especially at night; and, when this symptom is present in any case of obscure dermatitis, it is always well to bear scabies in mind. The diagnosis can usually be confirmed by examining the fingers of the mother or nurse. Urticaria papulosa is the disease most often mistaken for scabies.

Treatment.—Provided the application of the treatment is sufficiently thorough, scabies can always be cured in a few days. The child should have a prolonged warm bath and be well rubbed all over with soft soap. After the bath, the ointment should be thoroughly applied and left on for the night. It is to be reapplied every morning and evening for three days. On the fourth day, clean clothes and sheets are substituted for the soiled ones, which are taken away and sterilised by boiling. If sulphur ointment is used, it should be diluted with equal parts of simple ointment. If much irritation of the skin is present, Kaposi's naphthol ointment (Appendix I, Form. 23) may be preferred to a sulphur preparation. Considerable irritation of the skin is often left after the itch is cured; this may require further soothing treatment in the form of zinc and boracic ointment and daily sponging with a tarry lotion (liq. pic. carb. 1 drm., aquæ 1 pint) for a week or so. It is, of course, necessary that all infected persons in the house should be treated at the same time.

Pediculosis.

Pediculus Capitis.—The commonest form of pediculosis in children is that of the scalp. In many cases its presence causes little discomfort. In others, there is considerable itching, and it may set up contagious impetigo of the face, scalp, and neck. There are generally few pediculi and many nits, as each female lays from 50 to 100 eggs, and each egg

takes about a week to hatch. The diagnosis depends on the recognition of the nits; and the presence of impetigo on the face should always suggest a search for them.

The hair should be soaked for two nights and a day with equal parts of paraffin and olive oil. This is washed off with soft soap and hot water on the second morning, and the nits are removed with hot vinegar and a fine tooth comb. Oil of sassafras is also a useful application. It is not necessary to cut the hair short, but doing so saves a great deal of trouble.

Pediculus Corporis.—The body louse is rare in little children. Its main treatment consists in baking the infected clothes, or going over their seams with a hot iron, and then rubbing white precipitate ointment into them.

Pediculus Palpebrarum.—The pediculus pubis is occasionally found on the eyelashes of much neglected children who have been infected from their mother's axilla. The parasites and nits should be removed by forceps, and calomel dusted on, or a weak mercurial ointment applied.

Ringworm.

Ringworm may affect the scalp (*Tinea tonsurans*), the skin of the body (*T. circinata*), or, much less commonly, the nails (*T. unguium*). On the scalp and nails it is usually due to infection from other children; but, when the disease is on the body only, it may have come from a dog or cat.

Tinea Tonsurans.—Ringworm of the scalp is practically confined to children of school age (seven to fourteen), and those who have been born in India, or are delicate from other reasons, are specially prone to take it. It may be caused by either of two kinds of fungi, microsporon Audouini—the small spored—and trichophyton megalosporon—the large spored variety. In Scotland most of the cases are due to the small spored kind.

In typical cases of the *small spored variety*, the disease first shows itself on the scalp, as a small, pale, scurfy, partially bald spot. On this, most or all of the hairs are dull and broken over, and their ends are ragged and brush-like. This appearance is so easily seen with a lens and so characteristic, that microscopic examination is generally unnecessary. When

they are examined under the microscope, however, the surface of the broken hairs is seen to be thickly covered with a mosaic of spores.

In other cases, the disease is much more widely spread through the scalp, and diseased hairs are found scattered here and there among the healthy ones. In this, as in all varieties of ringworm, the diagnosis rests solely on the discovery of diseased hairs.

The Large Spored Variety also produces a rounded bald spot on the scalp. In one form of it, the hairs are so brittle that they appear like little black dots, and it is difficult to get hold of them with forceps; in another form, the hairs are longer and less brittle and there is little scurf on the patch. On microscopical examination of the large spored ringworm, the spores are seen in and round the hairs in rows, arranged in a loose network.

When there is difficulty in making sure of the presence of the fungus in any species of ringworm, the hairs should be carefully stained and examined under the microscope. Norman Walker gives the following method as satisfactory: The hairs are first washed in ether to remove the grease, and then steeped for from ten to thirty minutes in a saturated solution of gentian violet in aniline water. They are next transferred for two minutes to Gram's solution of iodine (iod. 1, pot. iod. 2, water, 300); then placed on a slide and dried firmly with blotting paper, and a drop of aniline oil, containing enough pure iodine to give it a light mahogany colour, is applied. The fungus will then be visible under a low power.

Kerion.—When Nature attempts to cure the ringworm patch by violent suppuration at the roots of the diseased hairs, we have the condition known as "kerion." The patch swells, becomes red and boggy, and the hairs fall out. The spontaneous cure though severe is unfortunately not usually complete, and sufficient diseased hairs are left to keep up the disease.

Treatment.—As the ringworm fungus penetrates to the bottom of the hair-follicles, it cannot be satisfactorily reached by parasiticide remedies; so that the cure must always be slow, and is rarely complete in less than twelve months.

When ringworm of the scalp appears in a family, the child who is affected should be isolated as much as possible from

the others, and should especially sleep alone. The hair of the other children should be cut short and washed daily to lessen the chance of infection. The greatest care must also be taken to avoid the common use of brushes, towels, and caps.

The patient's hair must be cut close to the head, and all diseased hairs that can be got hold of carefully epilated. The head should be scrubbed daily with an antiseptic soap; and an antiseptic ointment should be thoroughly and patiently rubbed into the scalp with the thumb for ten minutes twice a day. N. Walker[1] recommends for this purpose an ointment containing ½ drm. of tinct. iodi. to an ounce of goose grease. Two other prescriptions which he recommends will be found in Appendix I, (Form. 24 and 25). Another method of treatment consists in stimulating the skin to resist the parasite by the intermittent use of blistering fluid or pure carbolic acid.

The most efficient method of treatment is certainly that by the X-rays, if it is properly carried out. This treatment, however, is not devoid of risks, and requires much experience and skill in its application. For its details the reader must be referred to works on dermatology. If properly done, it may bring about a complete cure within three months. If unskilfully managed, the results are often disastrous. It is to be remembered that in any case spontaneous recovery may be expected to take place about the age of fourteen years, even without any treatment.

Kerion should be treated by soothing applications such as starch poultices, and by careful epilation on and around the patch.

Tinea Circinata.—On the body, ringworm produces somewhat rounded, slightly scaly rings of a pink colour; and in severe cases there may be small vesicles at the periphery (eczema marginatum). If a fragment of the epidermis is placed on a slide for ten minutes in liquor potassæ, the filaments of the fungus can be clearly seen under a low power.

The treatment of ringworm of the body is a very simple matter compared to that of the scalp variety. Destruction of the superficial epidermis by painting with the strong tincture of iodine, or inunction with ung. hydrarg. ammon. chlor. (B.P.), will cure it in from six to ten days.

[1] *Introduction to Dermatology*, 1911, 203.

Tinea Unguium.[1]—Ringworm of the nails is an even more troublesome disease than that of the scalp. It is caused by the large-spored fungus, and is very rare in children. In the few cases I have seen, it was not associated with ringworm elsewhere. Its appearance is very characteristic (Fig. 93), but it is often mistaken for simple onychia. The fungus can be found in fragments of the nails, if they are steeped overnight in liq. potassæ.

The *treatment* by soaking with Fehling's solution which N. Walker recommends is much too painful to be used in

FIG. 93.—Ringworm of the Nails. (Dr Cranston Low's case.)

children. For them Cranston Low advises scraping with a blunt knife, and painting with tincture of iodine.

Favus.

Favus is still prevalent in some places in Scotland, and its sulphur-yellow crusts on the scalp with their mousy odour are familiar to most practitioners. The similar cup-shaped yellow crusts on a reddened base which form on the body are more often overlooked. Favus unguium occasionally occurs.

The *treatment* of the disease on the scalp is usually difficult and prolonged. In the very early stages, epilation and the application of an antiseptic ointment may possibly succeed; but, later, nothing short of the X-rays is usually successful.

Favus of the body, which is sometimes due to a different species of the fungus derived from cats or mice, is rapidly

[1] R. Cranston Low, *Edin. Med. Journ.*, Feb. 1911, 121.

cured by removing the crusts and applying a parasiticide ointment.

Alopecia.

In young children irregular patches of baldness on the scalp and eyebrows are characteristic of congenital syphilis, especially when the remaining hair is copious ("syphilitic wig") (Fig. 235).

In older children bald patches may result from severe seborrhœa and from ringworm. A diffuse loss of hair may occur after attacks of debilitating illness, especially after erysipelas. The hair usually grows in again rapidly. In cretins a considerable temporary loss of hair is usual during the beginning of thyroid treatment.

Alopecia Areata.—The pale, rounded, bare patches of alopecia areata usually appear suddenly. The skin on them is smooth and often atrophic in the centre, and any broken hairs left are apt to be thinned near the root and shaped like a note of exclamation (!). They are quite unlike those of ringworm. In children, recovery practically always occurs after a number of months, but relapses are not uncommon. In rare cases, the alopecia spreads and becomes general.

Etiology.—The causation is obscure. The disease has been attributed to nervous influence, to the action of bacteria, and to toxins. In some cases it has proved to be contagious and large epidemics have been observed; but, in the great majority of instances, it does not spread.

Treatment.—Tonics and slightly irritating antiseptic lotions and ointments are indicated. N. Walker recommends lactic acid (Appendix I, Form. 26), sulphur ointment, and a lotion of hydrarg. perchlor. in spirit ($\frac{1}{2}$ to 2 per cent.). Ammonia lotions (Appendix I, Form. 27) are also useful. It is advisable to change the application from time to time.

In school children, it is well to insist on careful precautions being taken against the common use of caps, towels, etc., and close personal contact; but the rigid restrictions necessary in the case of ringworm are generally not required.

Diseases and Deformities of the Nails.

The nails are not very frequently affected, but their diseases are often of great interest, and they are sometimes helpful

because they may throw light on disease or deformity present elsewhere.

Onychia (inflammation of the matrix of the nail) may be due to various pyogenic organisms, to tuberculosis, or to congenital syphilis (Fig. 236).

Mycosis of the Nails may be caused by favus, or more commonly by ringworm (Fig. 93).

Hæmorrhage into the substance of the nails is occasionally seen in purpura.

Longitudinal Ridging takes place in the nails of fingers which have been persistently sucked for years.

Transverse Ridges sometimes mark the previous occurrence of severe acute illness, such as scarlet fever, enteric, or pneumonia.

Exaggeration of the Curve of the nails is seen in dwarfing of the terminal phalanges, and, generally, in clubbing of the finger-ends from congenital malformation of the heart and other causes.

The appearance and significance of *bitten nails* have already been referred to (p. 81, Fig. 47).

Thickening of the Nails is sometimes present as a local, non-inflammatory disease of obscure origin and of no general significance; sometimes it is met with in congenital syphilis and in psoriasis.

Defective Development and Growth of the Nails are sometimes seen on the ill-formed fingers and toes of mongols and other mentally defective children. A rare congenital, hereditary, and family condition is occasionally met with (p. 727), in which parent and several members of a family show marked arrest of development of the nails along with either absence or extreme smallness of the patellæ.

CHAPTER XVII

ON THE TEMPERATURE

Temperature in Health.

Taking the Temperature.—In older children, as well as in babies, the temperature is best taken in the rectum; but, for ordinary purposes, it is more convenient to use the groin or axilla. In young children the groin is generally preferable to the axilla, for it can be reached with less undressing, and the child is more willing to sit still with the thigh bent on the abdomen than with the arm held close to the side. The thermometer should not be trusted in the mouth in children under four years old, and, even at that age, only when the child is intelligent and not agitated. When the temperature is taken in the rectum, the thermometer should be oiled before insertion and should be held in place for three or four minutes. When the groin or axilla is used, care must be taken to make sure that the skin is dry. In either the axilla or groin, an ordinary thermometer should remain about ten, and a "half-minute" thermometer about five minutes, if complete accuracy is desired. If the skin in either situation is cold to begin with, a longer time may be required. In the mouth, five minutes is needed for an ordinary, and at least three for a "half-minute" thermometer.

The temperature must always be taken in the same place each time, as the rectal temperature is considerably higher than that in the axilla or groin. According to Demme[1] the difference between the rectal and axillary temperatures may be from ·5° to 1·6° F. in normal children, and from ·9° to 1·9° F. in those who are ill.

Normal Temperature.—At birth, the infant's temperature is a few points above that of the mother. In the course

[1] 14ten *Jahresbericht des Jenner'schen Kinderspital in Bern*, 1877, 7.

of a few hours, it falls below normal, but soon rises again. During infancy and childhood, the normal temperature is usually said to be a little higher than in adult life; but, according to Finlayson,[1] the mean temperature is really about the same, only the daily range is greater. The exact contour of the daily curve varies somewhat with the age of the child,[2] as well as with his times of sleep, the amount of his activity, and other circumstances.

Subnormal Temperature.—During the first three or four months of life, there is a great tendency for the temperature to fall very low. In premature and atrophied babies, it often remains constantly subnormal—97°, 96°, 95° F., or even lower. When this condition is present, a rise to 98° or 99° F. may indicate the presence of fever. After any period of pyrexia in childhood it is usual, and a good sign, if the temperature remains subnormal for some days.

A prolonged subnormal temperature in a young baby, when accompanied by other signs of ill-health, is a disquieting sign, though it is not always of serious significance. Sometimes it depends on a defect in the diet; too little carbohydrates and withdrawal of salts from the food are both said to cause it.

Pyrexia.

Young children are more prone than adults to pyrexia from slight causes, and any cause generally produces a higher degree of fever. This may be partly accounted for by the greater dryness of the child's skin in feverish conditions. Emotional causes are also apt to raise the temperature, which probably accounts for the slight rise which normal children sometimes show during the first night they spend in a hospital ward.

Rapid rises of temperature from trivial causes are so common in childhood that pyrexia alone is not a sufficient reason for anxiety. Generally it is only when it continues for some time, or is accompanied by other disturbances, that a high temperature becomes a serious symptom.

[1] *Keating's Cyclopædia of the Diseases of Children*, Art. "Diagnosis," 1889, 98; and *Glasgow Med. Journ.*, Feb. 1869, 186.

[2] Jundell, *Jahrb. f. Kinderheilk.*, May 1904, lxxix., 521.

Sudden Rises of Temperature.—When the temperature of a healthy child rises suddenly and keeps up, the onset of one of the exanthemata or of influenza may be suspected. Careful and repeated examination should be made for signs of pneumonia. Inspection of the throat is *never* to be omitted; and otitis must also be remembered as a common source of fever. In many cases the pyrexia may be found to depend on a passing disorder of the digestion, in which case, an emetic or aperient will act as a rapid antipyretic. In nervous children, very considerable remittent or intermittent fever may be caused by the irritation of teething (Fig. 94). Erysipelas

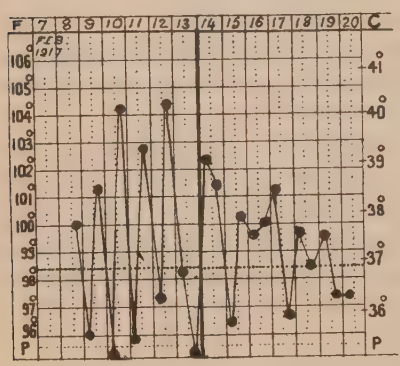


FIG. 94.—Pyrexia, apparently from Teething only. Nervous boy of 19 months.

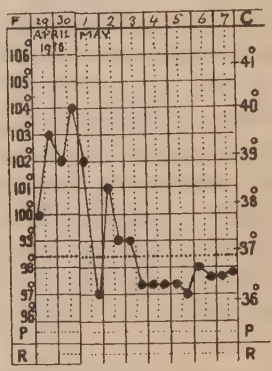


FIG. 95.—Pyrexia from Concentrated Urine, with uric acid crystals. Boy of 4 weeks.

and cerebro-spinal meningitis are other occasional causes of high fever, and the possible presence of a surgical lesion such as acute osteo-myelitis is not to be forgotten.

Holt has drawn attention to a type of pyrexia frequently seen in breast-babies between the second and fifth days of life which he calls "*Inanition Fever.*" The immediate cause of the rise of temperature, in these cases, seems to be that the child is getting little or no milk from the breast, and is therefore suffering from local irritation of the internal urinary passages by the concentrated urine.[1] In slight cases, there are no special symptoms beyond the fever, thirst, and loss of weight. In those which are more severe, the infant is

[1] Comby, *Arch. de Méd. des Enfants*, Oct. 1899, ii., 580.

collapsed, restless, and apathetic and looks very ill; occasionally convulsions occur; the loss of weight may be considerable.

As the symptoms are due to want of fluid, the treatment which is usually rapidly successful, consists in giving an extra ounce of water every two hours, and if this does not suffice, putting the baby to a wet nurse or on the bottle.

Occasionally we meet with the same condition in children of three or four weeks who are suffering in a similar way from lack of fluid, and passing concentrated urine containing uric acid crystals and sometimes albumin. The child's condition may appear serious, but the administration of copious draughts of water, and alkalinisation of the urine with citrate of potash are followed by a rapid fall of the temperature and disappearance of the other symptoms (Fig. 95).

Persistent or Recurrent Rise of Temperature.—When there is persistent or recurrent remittent fever without any ascertainable organic cause, the diagnosis is often very perplexing. Such a condition may, of course, be due to unrecognised tuberculosis in the peritoneum or elsewhere, or to malaria, influenza, or enteric. Some cases of erythema nodosum also have for a time a temperature very like that of mild enteric. Occasionally children, who have lived on the Mediterranean or in India, and have been fed on goats' milk, show the peculiar long-continued irregular type of fever which is characteristic of Undulant or Malta Fever. This is well shown in Fig. 96.

In obscure persistent fever, the condition of the mouth and throat must *always* be investigated, as even slight stomatitis and tonsillitis are capable of causing a considerable degree of pyrexia; and occasionally the removal of a bad tooth puts an end to a prolonged fever. The microscopical examination of the urine also should never be neglected, especially in babies, for in them both pyelitis and nephritis may be responsible for a high remittent temperature (p. 380); and it is to be remembered that the pyrexia sometimes occurs some days before pus appears in the urine. Unrecognised patches of broncho-pneumonia, and in rheumatic children endocarditis and myocarditis, are also occasional causes of fever. Whooping-cough in its early stages is another occasional cause. Many obscure cases of prolonged high temperature are attributable to the absorption

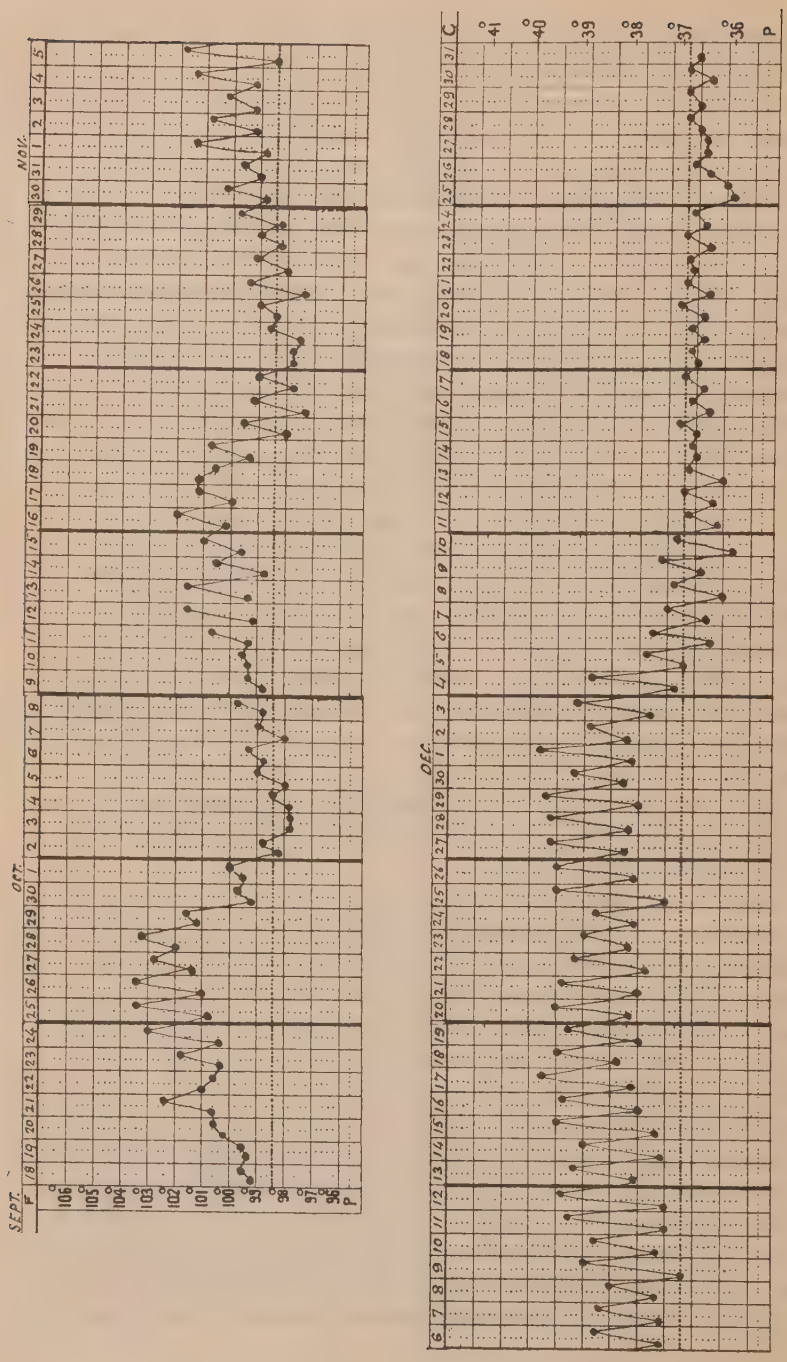


FIG. 96.—Undulant or Malta Fever. Girl of 5 years.

of intestinal toxins, and pyrexia is a characteristic symptom of alimentary poisoning. Some forms of pyrexia seem to be of a purely nervous origin. The recurrent attacks of fever which are associated with acetonæmia are referred to elsewhere (p. 459).

When a child's temperature has been high for any reason for some time, it may continue rising periodically for weeks after the original cause has apparently gone. For example, after severe attacks of whooping-cough, it is not uncommon to find the temperature rising at nights to a considerable degree for many weeks. This may give rise to much anxiety as it suggests the possible onset of tuberculosis; but there is generally no real danger in these cases. Another much more serious type of persistent pyrexia is that which, rarely, follows an acute attack of influenza in a young child (see Figs. 97 and 98). In these cases the temperature instead of falling to normal in a few days, as it has done in the other children of the family, continues for weeks to exhibit a high remittent type although there are no indications of disease in any of the organs. The pyrexia seems the only symptom, and the child sleeps well, looks well, eats well, and has normal motions. The fever seems, sometimes at least, to depend on a severe derangement of the heat-regulating apparatus, rather than on a continued infective process. The majority of the cases last only a few weeks and end in recovery. They cannot, however, be regarded without anxiety, for weeks of severe pyrexia lower the child's resistance to disease to a dangerous extent, and after a time there is a great risk of an intercurrent attack of pneumonia or nephritis. In these cases, open-air treatment is of the greatest importance. Fig. 97 shows the temperature curve of a previously healthy baby of eight months with this condition, who was treated without any special amount of fresh air, and who ultimately died from broncho-pneumonia and nephritis of a few days' duration. No tuberculosis was found. Fig. 98 is the chart of another child of eighteen months whose case was at first very similar to the last; but who gradually improved on being treated largely in the open air, and ultimately made a good recovery.

If the cause of the pyrexia in any case remains undiscovered, we must, of course, be guarded in our prognosis. It is, however, a comforting fact that the very great majority of cases in which

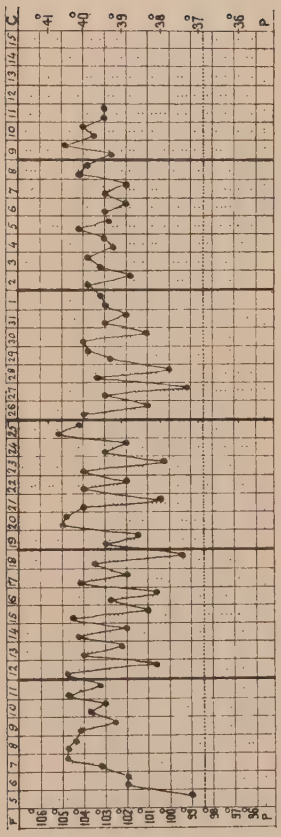


FIG. 97.—Prolonged Influenzal Pyrexia, ending fatally. Girl of 8 months.

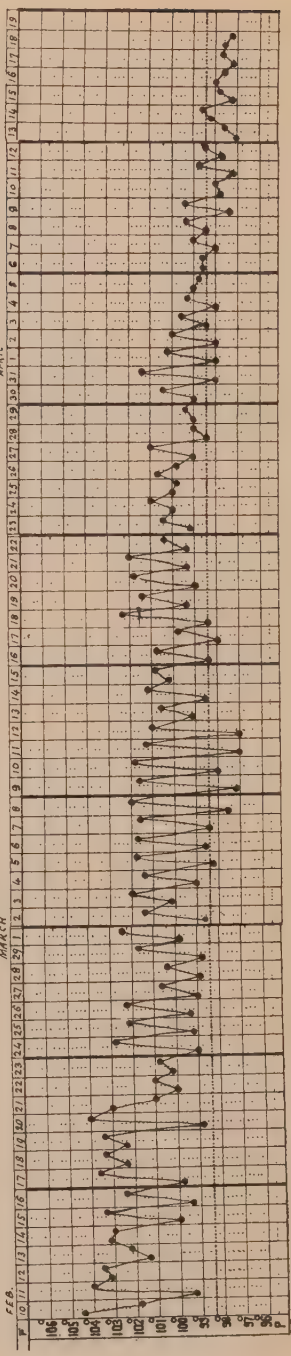


FIG. 98.—Prolonged Influenzal Pyrexia. Recovery under open-air treatment. Girl of 18 months.

nothing but pyrexia can be found, end favourably. Prolonged pyrexia without apparent cause is generally a clear indication for the use of open-air treatment.

Hyperpyrexia.—It is not very rare in babies to meet with hyperpyrexia. It occurs in various diseases, but is oftenest found in cases of severe intestinal derangement.[1] Its occurrence in them is ascribed to absorption of the toxins of non-pathogenic organisms taken in decomposing food.[2] When it occurs in such cases, it is a sign of great danger as convulsions and coma are apt to ensue, and it calls for prompt and active treatment. The stomach should be washed out and a dose of calomel or castor oil given. All fermentable food, and especially all forms of milk, must be withheld. Stimulants and subcutaneous saline injections are to be freely given and cold applied to reduce the temperature. Opiates of any kind should be avoided.

In very young and feeble infants the injudicious application of artificial heat (*e.g.* from hot-water bottles) may cause an alarming rise of temperature. Holt mentions one case in which the temperature rose to 107° F. from this cause. The fact that rheumatic hyperpyrexia is unknown in young children, and very rare in older ones, is referred to elsewhere (Chapter XXXV.).

Rigors.

The occurrence of rigors at the onset of fever is rare in childhood, and especially so in early infancy. Their place seems sometimes to be taken by convulsions, although it is doubtful whether this occurs as commonly as has often been said,[3] or by vomiting. In older children they may be a symptom of many various conditions—such as scarlet fever, enteric, malaria, and pneumonia, and are especially met with in acute septic bone disease and inflammations of the urinary tract.

When rigors occur in infants under two years, they have considerable diagnostic importance, because they are almost always due to the presence of acute pyelitis (p. 380). I have met with severe rigors in girls as young as five and seven months who had this disease.

[1] Chapin, *Arch. of Pediat.*, Nov. 1895, 917; Milton Miller, *ibid.*, May 1897, 347.

[2] Centanni, *Deutsch. med. Wochenschr.*, 22nd Feb. 1894, xx., 176.

[3] Baldwin, "Rigors in Children," *Lancet*, 13th June 1896, 1635.

CHAPTER XVIII

ON THE URINARY SYSTEM

In the clinical examination of children few things are more important than the investigation of the urinary tract. Its maladies are not uncommon; they are frequently serious; and they are very easily overlooked. This is especially true in early infancy, because then even acute diseases of these parts may exist without giving rise to any ascertainable localising symptoms, apart from the state of the urine. A knowledge of the condition of the urine is also often essential for prognosis as well as for diagnosis. Even in the matter of treatment it is not without importance, for there are many drugs which should never be given in full doses until we have ascertained that the urine is fairly normal in amount as well as in character.

The Kidneys.

Acute Nephritis.—*Causation.*—Scarlet fever is, of course, the most important cause of nephritis in childhood. The discovery of albuminuria should *always*, therefore, suggest an inquiry as to recent sore throat and fever, as well as a careful examination for traces of desquamation. Nephritis, however, very often occurs quite apart from scarlet fever. Sometimes it is met with as a complication of other infective diseases such as whooping-cough, measles, diphtheria, erysipelas, chicken-pox, smallpox, mumps, septicæmia, pneumonia, glandular fever, tonsillitis, and gastro-enteric catarrh. It is also quite common as a primary disease, brought on merely by exposure to cold.

Symptoms.—Many serious cases of acute nephritis begin insidiously, and dropsy suddenly makes its appearance with little or no rise of temperature and with no subjective symptoms. In rare cases the œdema may be considerable some hours before

albumin appears in the urine. Sometimes headache, vomiting, and diarrhœa are the first symptoms complained of. In many instances there is no dropsy, although the urine is loaded with blood, pus, and tube-casts. These cases are usually of a less serious type than those in which dropsy is a prominent symptom, and tube-casts are few or absent.

The *treatment* of acute nephritis in childhood is in no way peculiar. The patient should be put between blankets and kept on milk and barley water. The skin must be made to act freely by the use of warm baths, hot packs, or hot air baths. With the same object, liquor ammoniæ acetatis, or in bad cases pilocarpine ($\frac{1}{15}$ to $\frac{1}{4}$ gr. by mouth), may be given. The action of the kidneys is to be encouraged by alkaline diuretics and by giving fluids freely. The administration of large enemata of warm water is useful for this purpose. Poultices (plain or mustard) over the loins are also indicated. The bowels should be kept freely open by saline purgatives and by occasional doses of calomel.

In some cases rapid and dangerous dilatation of the heart takes place. When this occurs, venesection with the removal of from 6 to 12 oz. of blood, according to the patient's age, is urgently called for and generally brings immediate relief.

Chronic Parenchymatous Nephritis. — Cases of acute nephritis not infrequently pass into a chronic stage and last for months or years. The chief symptom is œdema, which varies from time to time in severity and is often extreme. The amount of urine passed also varies greatly, being at times considerable and at other times, during exacerbations, only amounting to 2 or 3 oz. in the day. The urine contains more or less albumin, nearly always tube-casts, and occasionally blood. Its specific gravity is fairly normal.

These cases sometimes last for several years and are apt to end fatally from complications in the lungs, pericardium, or elsewhere, or from uræmia. If the patient, however, has formerly been a healthy child, and if he is under continuous careful nursing, his chances of ultimate recovery are surprisingly good, considering the apparent hopelessness of the symptoms. The children, in some instances, remain chronic invalids; but very often complete recovery takes place after months or even years of severe illness. We should, therefore, be slow to abandon hope in any case of this kind.

Treatment.—The exacerbations in chronic parenchymatous nephritis have to be treated like an ordinary acute attack. During the intervals, the action of the skin is to be encouraged by woollen clothing and regular warm baths. The child should, if possible, winter in a warm climate. It is unnecessary to endanger the general health by too strict a diet, provided articles which are rich in extractives, and all spiced foods are prohibited. When the œdema is troublesome, a salt-free diet should be tried (Appendix J). Sometimes it has little effect, but usually it is very beneficial.

Decapsulation of the Kidneys (Edebohl's operation) has been recommended in severe cases by Koplik and others; and, in several instances, I have seen it followed by complete and unexpected recovery. It is thought by many that it should never be considered until all other measures have failed; and that, taking into account the frequency with which even severe cases ultimately recover under medical treatment, it is doubtful whether it is justified. On the other hand, however, it may be said that the operation is not at all a serious one, and that immediate improvement not very rarely follows it.

Interstitial Nephritis (*Cirrhotic Kidney*).—This is a very uncommon disease in childhood, but it may be met with even in young infants. The patients usually have a history of having been delicate, dyspeptic, and stunted in growth all their lives, and they are often the subjects of infantilism.

The main symptoms[1] are greatly increased arterial tension with cardiac hypertrophy, an increased amount of urine containing little albumin and some tube-casts, excessive thirst, frequent headaches, and continued loss of weight. Œdema is rare, except with heart-failure, towards the end. Uræmia is the usual cause of death.

Uræmia.—This is a relatively uncommon occurrence in young children. Occasionally the symptoms are very like those of tuberculous meningitis. It is to be treated in the usual way, by purgatives and hot-air baths, and by poultices to the loins, cupping, leeches, or venesection. When convulsions occur, chloroform or chloral may be given, or even a hypodermic injection of morphine. The removal of a few drachms

[1] James E. H. Sawyer, *Birmingham Med. Rev.*, August and September, 1903, 511 and 549.

of cerebro-spinal fluid by lumbar puncture sometimes gives decided relief and is always worth trying.

Tumours of the Kidney are generally either sarcomata or carcinomata. They are commonest in early childhood, being rare after six years. Generally few subjective symptoms, if any, are present until the later stages of the disease, though a considerable amount of blood may appear in the urine.

When the condition is recognised early, a surgical operation may be advisable, but the prognosis is very bad; for extremely few cases are on record in which the disease did not recur after removal. Many of the tumours in the renal region arise in the suprarenal gland (p. 434).

Perinephric Abscess is not very rare in childhood. It may be connected with disease of the spine or lower ribs; but if on the right side, it is generally secondary to gangrenous inflammation of a high appendix. At an early stage of the disease, the symptoms may simulate those of hip-joint disease.

Renal Calculus is rare in early childhood. When present it is apt to escape recognition, owing to the difficulty of getting a full account of the symptoms. If its presence is suspected, X-ray photographs should always be taken.

Hydronephrosis may be either unilateral and acquired, or bilateral and congenital.

Acquired, Unilateral Hydronephrosis is usually found in older children, and is recognised by the tumour which it forms. It may be due to a stone impacted in the ureter, to peritoneal adhesions, or to some other organic obstruction to the outflow of urine; but the cause is often quite obscure. It may give rise to little interference with the general health, even when of large size. Excision of the affected kidney is generally the best treatment.

Congenital Hydronephrosis. — This is usually bilateral, and with it there is great dilatation of the ureters. It is accompanied by congenital hypertrophy of the bladder, and the course and prognosis are those of that condition. It is generally associated with obstruction in the posterior urethra from folds in the mucous membrane (*v. infra*). Its presence may always be inferred with confidence whenever a greatly thickened bladder is felt in a young infant.

Congenital Hypertrophy of the Bladder.—This condition occurs in boys only, and depends on an antenatal over-

growth of the muscular wall. The hypertrophy is evidently secondary to muscular over-action from obstruction to the outflow of the urine; but, until recently, no form of organic obstruction had been discovered which could be regarded as its usual cause. It was therefore suggested, as the probable explanation of the hypertrophy, that it was due to the existence, *in utero*, of a state of inco-ordination between the sphincter and detrusor muscular apparatus of the bladder, and that the process was therefore analogous to what is believed by many to occur in congenital hypertrophy of the pylorus and stomach-wall, and in megalocolon.[1] This hypothesis may have to be given up, as *congenital obstruction of the posterior part of the urethra* of various forms has now been shown to be present[2] in most of these cases, which appears to supply a possible explanation of the symptoms, and the hypertrophy of the bladder.

This obstruction consists in the presence of abnormal valves or folds of mucous membrane in the posterior urethra in the vicinity of the external sphincter; and it has been demonstrated that the condition is generally present when the bladder is hypertrophied from birth. The urethra above the site of these folds, and the internal sphincter also are much dilated.

While it is possible that these folds may turn out to be the real cause of the obstruction, it seems more probable that they are only a secondary result of a functional abnormality, and closely analogous to the similar longitudinal folds of mucous membrane which are always found in pyloric stenosis, and are almost certainly a result of the muscular hypertrophy (p. 295).

When the bladder is hypertrophied, the pelves and ureters are always extremely dilated; and in many instances the ureters are so large that they look like coils of small intestine (Figs. 99 and 192). This dilatation seems to be due to the constant over-action of the hypertrophied bladder, which not only stops the normal downward flow through the ureters, but also forcibly drives the urine back into them and up to the kidneys.

The very rare condition of congenital absence of the

[1] Thomson, "On Defective Co-ordination, *in Utero*, as a Probable Factor in the Causation of Certain Congenital Malformations," *Brit. Med. Journ.*, 1902, ii., 678.

[2] H. H. Young, W. A. Frontz, and J. C. Baldwin, "Congenital Obstruction of the Posterior Urethra," *Journ. of Urol.*, October 1919, iii., No. 5, 289.

abdominal muscles (p. 694) has been shown to be, almost certainly, secondary to an extreme dilatation of the bladder of this sort, which has taken place early in intra-uterine life and has, later, been partially recovered from.

The *symptoms*, which require careful investigation to be discovered, are of four kinds:—

(*a*) Owing to the obstruction, there may be a history of incontinence, dysuria, and occasional retention; and, on micturition, the stream may have been noticed to be very small.

(*b*) The great dilatation of the pelves and ureters usually gives rise to ill-defined abdominal distention.

(*c*) When the kidney-tissue begins to suffer from the hydronephrosis, signs of diffuse chronic nephritis set in, such as pallor, vomiting, and diarrhœa, and ultimately uræmia.

(*d*) Sooner or later, bacillus coli infection of the urinary tract occurs, with the usual symptoms of that condition in a severe degree — loss of appetite, wasting, debility, pyrexia, rigors, profuse pyuria, and leucocytosis.

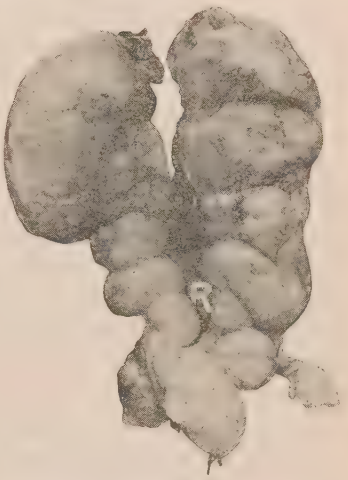


FIG. 99.—Congenital Hypertrophy of the Bladder. Death from pyonephrosis. Boy of 7 weeks.

The *diagnosis* is founded partly on the history of the past symptoms, but mainly on the presence of the greatly hypertrophied bladder, which is found in no other condition at this age, and from the ill-defined swelling in the region of the kidneys and ureters. The site of the obstruction may, in older cases, be demonstrated by passing a catheter; but, in the commonest form of the malformation, the catheter may pass easily into the bladder, owing to the concavity of the valvular folds being directed upwards. The use of the X-rays shows the dilatation of the internal sphincter and posterior urethra above the obstruction.

Treatment.—Various operations to remove the abnormal folds have proved completely successful in older patients when

undertaken before serious secondary changes had taken place in the upper urinary passages. This success may very possibly, as Mr Henry Wade has pointed out to me, be analogous to that obtained in pyloric cases by Loreta's operation.

Renal Tuberculosis.—Small tubercles are often found, post-mortem, in the kidneys in young children as part of a general tuberculosis. Much less frequently, renal tuberculosis occurs as a more or less isolated affection in an otherwise fairly healthy child. It is most important to recognise these cases early, because the infection in them begins in one or other kidney and spreads from it to other parts, and treatment in an early stage may prevent this extension. Incontinence of urine is an early symptom, and later frequent micturition and dysuria are very characteristic. Towards the end, pain may be felt in one or other loin. In any case, where pus is found in the urine apart from the presence of any of the ordinary pyogenic organisms, a careful search should be made for tubercle bacilli in the centrifuged deposit. If none are found, injection of the matter into a guinea-pig may give positive information. Von Pirquet's cutaneous reaction is, of course, often helpful in young children, and valuable aid in localisation may be got from an injection of old tuberculin, owing to the symptoms (local pain, increase of pus, and hæmaturia) which it sets up.[1] In girls, and in boys over eight years or so, much may sometimes be learned from a cystoscopic examination.

Treatment.—In cases diagnosed as instances of early renal tuberculosis, great and permanent benefit is sometimes obtained from a course of old tuberculin injections; and this treatment is well worth trying if there are reasons against an operation. When the disease, however, is definitely one-sided, nephrectomy should always be performed without delay. Children stand the operation well, and the result is often entirely successful.

The Bladder.

In young children the bladder is situated so high that it is an abdominal as well as a pelvic organ. Special care must

[1] C. A. Leedham Green, "Diagnosis of Urinary Tuberculosis in Children," *Rep. Soc. Dis. of Children*, 1907-8, viii., 450.

always, therefore, be taken to see that it is empty before tapping the abdomen.

Micturition.—The infant often passes water immediately after birth, as urine is freely secreted during intra-uterine life. Not infrequently, however, none is passed for the first twenty-four hours, or even longer. During the early months of infancy incontinence is the normal condition.

In the first two years the child generally passes water very frequently while awake, though during sleep he can retain it for two to six hours. By the third year the urine may be held during sleep for eight or nine hours, and, when awake, for two or three hours. The intervals between micturition steadily increase as the child grows older. Some infants have acquired control over their bladder by the time they are eighteen months or even a year old. In others this comes considerably later, but much depends on the training the children receive. If a child cannot control his bladder to a considerable extent, however, during his waking hours, by the time he has reached his third year, he may be regarded as suffering from incontinence.

Retention of Urine.—Retention is not a very common symptom in childhood. In boys it may be caused mechanically by a calculus which has become impacted near the meatus; and sometimes it is due to phimosis. It may also arise reflexly from irritation of the rectum by thread-worms, or from an anal fissure. Sometimes it is met with in enteric fever, and in the early stage of tuberculous meningitis; occasionally it occurs, even in children as young as six years, as a hysterical symptom.

Increased Frequency of Micturition (*Pollakiuria*).—A tendency to pass urine at too short intervals is often present along with enuresis, but it may occur alone, merely as a nervous symptom without any local cause. Sometimes it is aggravated by acidity of the urine, by the presence of uric acid or oxalate crystals, or by bacteriuria. Its onset in a little child should suggest examination of the urine for signs of cystitis from bacillus coli infection, for it is not uncommon to find that frequent micturition has existed for a week or two before the onset of acute pyelitis; and prompt treatment will prevent the upward extension of the disease.

Pollakiuria may occasionally be relieved by belladonna and

bromide, or, if the urine is acid, by its alkalinisation. In the great majority of cases, however, treatment of the child's mental condition is the most important part of the treatment. The habit is generally associated with enuresis; and the fear of wetting himself keeps the child in a constant state of mental unrest, which greatly interferes with his recovery. If the child's clothing, the climate, and the surroundings generally were such that the habit could be entirely ignored and treated as of no consequence, it would probably cease rapidly in most instances. These children should have their pelvis, thighs, and legs kept thoroughly warm.

Incontinence of Urine.—Enuresis is a common and important symptom in early life. It is met with in a severe form in many forms of mental defect and in organic nervous disease. Occasionally it is a symptom of nocturnal epilepsy or diabetes. When it has existed continuously from birth, some local malformation should always be looked for, if the patient is a girl.

In the great majority of cases, however, incontinence of urine is a pure neurosis, which, though favoured by the presence of local irritation or slight derangement of the urinary tract or of the urine, depends mainly on an ill-regulated and badly trained state of the child's nervous system, with a consequent mental flabbiness and lack of self-control. It is especially common among the upper classes, and the tendency to it is often hereditary. It is important to realise to what a large extent it is encouraged, in many instances, by the unconcealed apprehensions of the parents and by their injudicious suggestions, which increase the child's shame and distress, and diminish the self-confidence on which his recovery so largely depends. In young children the habit is seldom made so much of by their elders, and consequently is rarely so severe. Similarly, we often find that children who suffer badly from it at home, recover rapidly when admitted into a hospital ward, where their wetting is treated in a less emotional way.

The local abnormalities which sometimes favour and aggravate the habit are numerous. There may, for example, be concentrated ammoniacal or highly acid urine or bacilluria. A long redundant prepuce which is constantly the seat of inflammatory irritation, and narrowing or excoriation of the meatus, are other not uncommon auxiliary causes, even when

no phimosis exists. Unnecessary circumcision is not an infrequent cause. Rectal irritation from thread-worms is sometimes to blame.

Chills from any cause are certainly important as predisposing causes, perhaps owing to their favouring the occurrence of mucous catarrh (Eustace Smith); and there is generally a tendency for the habit to be worse during the cold and wet seasons. Any influences which tend to cause restless sleep—such as emotional excitement before going to rest, too warm coverings in bed, or the presence of adenoid growths, may also have a predisposing influence.

In many cases, the enuresis occurs to some extent during the day as well as at night, and, less commonly, it may be altogether diurnal. Generally, however, the micturition is normal, or merely too frequent, during the daytime, and the incontinence is nocturnal only. In a few instances there is a history of continuous enuresis from early infancy; but usually the child's control has been normal for months or years before the incontinence returned.

Treatment.—In treating a case of enuresis we must always bear in mind the necessity of taking the patient's mental condition into account. In a very few cases in older children, who are lazy and apathetic, the fear of punishment may do good. In the vast majority of instances, however, punishment does nothing but harm, and only aggravates the symptoms. Serious talks from his parents on the disgracefulness of the habit almost always make matters worse by concentrating the child's attention on the subject and making him exaggerate its seriousness. If an older child, who is indifferent about the matter, can be stimulated by hope of reward or otherwise to desire greatly to recover, and especially if he is made to feel that he is likely to do so, this has always a good effect. But when, as often happens, the patient is already painfully anxious to be cured, he must receive every possible encouragement, and be impressed with the fact that the condition is not so very terrible after all and that it always gets right in time. Especially, he must be assured that there is no blame whatever attaching to him in the matter.

Although the mental management of the case is generally the most important part of the treatment, other measures are by no means to be neglected. They are often of the greatest

benefit. In many cases this is largely because they encourage and help him to cure himself.

In beginning the treatment, obvious local abnormalities and general weakness must, of course, be dealt with first, and the urine examined. If cystitis is present, or the urine is abnormally acid or alkaline, these conditions should be treated. A narrow meatus requires dilatation, and an excoriation careful dressing with a suitable ointment. Phimosis and the retention of smegma are to be treated by separation of adhesions and stretching, or if necessary by circumcision.

The influence of chills in prolonging the habit is not to be forgotten. A cold douche carefully managed (p. 800) is sometimes very useful in bracing up the system; but, if it is carelessly given, it may be a source of renewed chills. The child should always be warmly clad, especially about the legs and pelvis. When the enuresis is nocturnal only, it is well to encourage the patient to practise holding his water for as long as possible during the day.

In most cases, the amount of fluid in the diet should be limited, especially during the latter half of the day; and the child should not be allowed to drink anything after 5 or 6 P.M. He should also be roused to pass water about 11 or 12 at night.

When, as very often happens, no obvious indication for special treatment exists, we must try the effect of tonics and of drugs which act on the nervous mechanism of the bladder; in many cases these are very helpful.

Preparations of belladonna or atropin should generally be first tried, especially in older children; and to be of use in nocturnal enuresis they must be given in full doses, so that some dilatation of the pupil and dryness of the throat are caused at bedtime. From 10 to 15 minims of the tincture of belladonna may be given at night to a child of five or six years; and an older child may have from 15 to 20 minims in the afternoon, and again at bedtime. If this is not enough, the dose may be gradually increased. A solution of atropin is sometimes preferred as being less variable in strength than the tincture. Holt recommends a solution of 1 gr. in 2 oz. of water. He begins with 5 minims of this in the afternoon and evening, for a child of five years, and gradually increases the dose to 10

minims. The medicine should be continued for some time after the enuresis ceases, and then be slowly diminished in amount. The addition of bromide to the atropin is often useful.

In cases in which the belladonna or atropin fails, we may in older children try cantharides, in the form of a blister over the sacrum, or give 1 or 2 minims of the tincture thrice daily. Liquid extract of ergot (20 to 30 minims, thrice daily) is sometimes effectual. I have found it surprisingly so in some cases of children between three and five years in whom belladonna had failed; but very often it has no effect. Liquor strychninæ, also, in 2 to 5 minim doses, may frequently be given with advantage along with belladonna. Liquid extract of rhus aromatica (10 to 30 minims, thrice daily) is another well-established remedy. It often aggravates the symptoms at first, and requires to be persevered with for many weeks. Of epidural and retro-rectal saline injections I have had no experience.

The treatment of enuresis by thyroid was first suggested by Hertoghe,[1] and has recently been recommended by L. Williams[2] and others. My experience agrees with that of Firth,[3] that it is specially useful in mentally defective children who have suffered from the habit all their lives. The dose should be small at first, beginning with $\frac{1}{4}$ gr. or $\frac{1}{2}$ gr., once a day. It may be gradually increased, at fortnightly intervals, up to 2 grs. twice daily. The larger doses are apt to increase the enuresis in some cases. The frequency and obstinacy of incontinence of urine in young cretins under thyroid treatment are interesting in this connection (p. 430).

Dysuria.— The upper urinary passages are very tender in little children, and concentrated urine or uric acid crystals may give rise to much obscure local pain and general distress. This is to be watched for in cases of frequent vomiting with pyrexia, especially in babies (p. 354). It can often be rapidly relieved by diluents and alkalies. In boys, pain on passing water is often due to phimosis or preputial adhesions, and disappears when these conditions are attended to. Spasmodic dysuria arises, not very rarely, from rectal irritation. It some-

[1] *Bull. de l'Acad. roy. de méd. de Belgique*, 27th April 1907, 267.
[2] *Lancet*, 1909, i., 1245.
[3] *Lancet*, 1911, ii., 1619.

times occurs as the first symptom in tuberculous meningitis. Painful and frequent micturition may, of course, be due to cystitis, to vesical calculus, and in older children to renal tuberculosis. They are also common and important symptoms in appendicitis and pelvic peritonitis.

Severe *spasmodic dysuria* is sometimes met with in little girls. The child has an urgent desire to pass water, and screams with pain when she tries to do so. This ailment can usually be speedily relieved by administering hyoscyamus and potash, or an opiate, and by giving diluent drinks and a hot hip bath.

Renal Colic.—Distinct renal colic with the passage of uric acid crystals occurs occasionally in infants.[1] It is often accompanied by a considerable rise of temperature (Fig. 95 and p. 355), obviously severe pain and general tenderness, sometimes with convulsions and with special pain on pressure over the region of the affected kidney, and retraction of the testicle on the same side. It rapidly recovers under alkaline treatment with diluents.

The Urine.

Its Collection. — In infants it is always difficult and troublesome to collect the urine for examination. Its amount, colour, and odour may be judged of, to a certain extent, from the napkins, and we sometimes find on them crystals of uric acid which look like grains of red sand. In all obscure cases, however, it is extremely important to obtain a proper specimen for microscopical as well as chemical examination. There are various ways of getting this. One plan—which is the least satisfactory — is to leave in contact with the genital organs a piece of absorbent cotton-wool which can be afterwards squeezed out into a glass. A simple device—which sometimes succeeds—consists in getting the nurse to waken the child from sleep and at the same time to exert steady pressure over the bladder. In the case of boys, a test-tube or bottle may be so fixed that any urine passed will find its way into it; and in that of little girls a padded bed-pan may sometimes be made use of successfully. If other means

[1] R. A. Gibbons, "Renal Colic in Infants," *Med. Chir. Soc. Trans. London*, 1896, lxxix., 41.

fail, or if the specimen is required for bacteriological purposes, a soft catheter should be passed.

Specific Gravity.—In young infants after the first two days of life the sp. gr. is often very low (1002 to 1004). It gradually increases with age, and in older children is usually, under normal conditions, from 1010 to 1030.

Reaction.—In children the urine is generally faintly acid. In young infants it often has, however, a strong tendency to turn alkaline soon after it is passed. A high degree of either acidity or alkalinity generally signifies some digestive or other disorder.

Quantity. — The daily amount of the urine varies considerably in different children, and also on different days according to the quantity of fluid taken and the amount got rid of by the skin and bowel. The following table (Holt) represents a summary of the results obtained by Schubanowa, Cruse, Camerer, Pollak, Martin - Ruge, Berti, Schiff, and Herter :—

Average Daily Quantity of Urine in Health.

Age.	Grams.	Ounces.
First twenty-four hours	0 to 60	0 to 2
Second twenty-four hours	10 „ 90	½ „ 3
Three to six days	90 „ 250	3 „ 8
Seven days to two months	150 „ 400	5 „ 13
Two to six months	210 „ 500	7 „ 16
Six months to two years	250 „ 600	8 „ 20
Two to five years	500 „ 800	16 „ 26
Five to eight years	600 „ 1200	20 „ 40
Eight to fourteen years	1000 „ 1500	32 „ 48

Goodhart and Still[1] have found the daily amount of urine passed by children over two years to be much less than is represented by these figures. They say that, for practical purposes, the average daily amount in ounces, between three and twelve years, may be arrived at with sufficient accuracy by multiplying the child's age by two and a half. Similar small amounts have been observed by Churchill and Kerley.

A diminution in the quantity of urine passed is often important as an indication that the baby is not taking enough

[1] *Diseases of Children*, 9th ed. London, 1910, 537.

milk, or not retaining it, as in the case of severe vomiting. It is also seen in profuse diarrhœa, and during the onset of effusions into the pleura and peritoneum in older children. Suppression of urine may sometimes be caused by certain drugs (such as antipyrine) as well as by acute nephritis. Increase in the amount passed is seen during the absorption of pleural and peritoneal effusions and œdema, also in diabetes and polyuria.

Urea. — The daily amount of urea passed amounts, in children from three to five years old, to 13 or 14 grams., and in those from five to thirteen years, to from 16 to 21 grams. (Holt).

Uric Acid.—The proportion of uric acid in the urine is much greater during the first eight or ten days than at any later period, and the kidneys often show an accumulation of crystals (uric acid infarcts) in the straight tubules. These crystals are usually washed out within the first week or two of life, and may be seen on the infant's napkins; their passage is, at times, a cause of dysuria, and of albuminuria and hæmaturia.

Phosphaturia.—Large quantities of triple phosphate crystals are sometimes found in children's urine. This may cause enuresis. I have seen it accompanied by severe dysuria in a little girl of four years old. Such symptoms are to be treated by acid phosphate of soda (5 to 10 grs., thrice daily), and a meat diet.

Ammoniacal Napkins.[1]—The wet napkins of some little children, many of whom seem quite healthy, emit a strongly pungent odour of pure ammonia, quite different from the unpleasant ammoniacal smell of decomposing urine. The urine of these children has no such odour when passed into a vessel. The ammonia is derived from the ammonium compounds in the urine. These are more plentiful in children of one or two years than in younger babies; but even in young infants they may be considerably increased by indigestion. The cause of the exhalation of the ammonia is to be found in the alkaline condition of the napkins, which is usually due to their having been washed with strongly alkaline soap and not properly rinsed out afterwards in clean water. It may also arise from the presence on them of alkaline stools.

[1] Zahorsky, *Amer. Journ. Dis. Child.*, 1915, x., 436.

If the napkins in these cases are not frequently changed, the ammoniacal fumes are apt to set up a painful irritation of the skin in the "napkin-area," especially on the prominent parts which are in closest contact with the cloths; this may even go the length of raising blisters.

In boys the end of the prepuce is often early affected in this way and, especially if the child has been circumcised, an obstinate chronic ulcer may form round the meatus, which is a cause of troublesome incontinence. In girls, the local irritation lowers the resistance to infection and probably favours the occurrence of bacillus coli invasion of the urinary tract.

Albuminuria.—The occurrence of albuminuria under many conditions, apart from nephritis or pyuria, is characteristic of childhood, and its presence is often of little importance. Generally, the finding of a small amount of albumin need cause no anxiety, provided the child seems well and there are none but hyaline casts, a normal specific gravity, and no cardiac enlargement. Albuminuria is sometimes set up by the application of tarry preparations or carbolic acid to the skin, and occasionally by the internal use of such drugs as chlorate of potash, antipyrine, salicylate of soda, and arsenic in large doses. It is also frequently present in some forms of dyspepsia and in food intoxication; and, in older children, it may follow habitual over-indulgence in butcher meat. As has been already mentioned, albumin is often found in the urine of new-born children along with the passage of uric acid crystals; and a similar occurrence in older children is a not uncommon symptom of lithæmia. In these cases, as Rachford[1] points out, it may be regarded as a danger-signal, because it indicates an amount of irritation of the kidney which, if it is allowed to go on long, may possibly end in chronic renal disease.

Albuminuria is so generally present in school-boys, after foot-races and other forms of violent exercise, that it is to be regarded as a normal occurrence under these circumstances.

Postural, Orthostatic, or Cyclic Albuminuria.—In older children (after seven years) and in adolescents, this variety of albuminuria is always to be kept in mind. It is a functional condition in which the albumin only appears when the patient is in the erect posture. On the child's getting up in the morning the urine is quite normal. Within an hour or two of

[1] *Arch. of Ped.*, 1898, xv., No. 8, 605.

his rising, however, a considerable amount of albumin is found. This increases during the forenoon and then diminishes in amount during the rest of the day, till by evening it is almost or quite gone. If the child is kept lying in bed, the urine remains free from albumin. No tube-casts, other than hyaline, are to be found, and there is never any blood.

The pathology of the condition is still obscure. Jehle[1] has attributed it to lordosis of the upper lumbar region, with consequent passive congestion of the kidneys; and an artificially produced lordosis has been shown to cause it occasionally. The posture alone, however, seems scarcely enough to account for the condition. Erlanger and Hooker[2] give reasons for believing that there is disturbance of the vaso-motor mechanism of the kidneys. Various functional abnormalities of the circulation have been described in children with this complaint; Götzky,[3] for example, found well-marked dermographia in his cases.

There may be no symptoms of ill-health at all, but often the patients are delicate, nervous children, with chronic intestinal indigestion. They are listless and headachy and have cold extremities. There is no enlargement of the heart, and generally no increase of pulse tension.

The *prognosis* is good so far as the renal anomaly is concerned. In many cases the albuminuria ceases between the fifteenth and twentieth year; but the general delicacy, of which it is a symptom, may continue long after. In some cases the condition has succeeded an apparently cured nephritis; and in many individual cases it is difficult to be quite certain that the kidneys are not diseased to some degree. We must remember that in slight cases of nephritis the amount of albumin sometimes varies regularly under the influence of posture.

The *treatment* of cyclic albuminuria consists mainly in attention to the general health. No medicine, no alteration in the diet, and no amount of rest have any distinct effect on the duration of the disease. The patient should not be kept in bed or treated as an invalid; but his exercise should be carefully regulated and his diet must not contain too much animal food.

[1] *Die lordotische Albuminurie. Ihr Wesen und ihre Therapie*, Leipzig and Wien, 1909.

[2] *Johns Hopkins Hosp. Rep.*, 1904, xii., 145.

[3] *Jahrb. f. Kinderheilk.*, 1910, lxxi., 427.

Hæmoglobinuria.—Paroxysmal hæmoglobinuria is not very rare in children, and the cases do not differ much from those in adults. The patients are usually the subjects of congenital syphilis. Hæmoglobinuria is sometimes met with as a concomitant of Raynaud's disease.

Coloured Urine.—A dark *sage-green* colour of the urine is found, along with blood corpuscles, albumin, and casts, in carbolic acid poisoning, either from absorption from dressings, or from the internal use of such drugs as salol.

Bright pink urine usually indicates that the patient has been eating sweets coloured with an aniline dye.

The very rare congenital abnormality known as *Alkaptonuria*[1] is characterised by urine which looks normal, when passed, and gradually darkens on standing to a brown and in time to a *black* colour. It reduces Fehling's solution, although it contains no sugar. Many of the cases of alkaptonuria reported occurred in more than one member of a family, and the patients are often the children of first cousins. The disease causes no symptoms, except slight dysuria; but the condition of the urine gives trouble on account of its staining the clothes. It is not amenable to treatment.

Hæmaturia.—This is a common, and generally an important and interesting symptom in childhood. It is met with under a great variety of conditions.

In young babies who are passing uric acid crystals there is often a small amount of blood in the water. It is also very common in infantile scurvy, and the presence of red blood corpuscles in the urine of cases that are doubtfully scorbutic is strongly in favour of the diagnosis of this disease. Scorbutic hæmaturia is sometimes met with apart from any other characteristic symptom of scurvy. In cases of renal tumour, hæmaturia generally occurs sooner or later. Blood in the urine is also found in many other diseases such as acute nephritis, some forms of cystitis, purpura, hæmophilia, leukæmia, calculus, genito-urinary tuberculosis, bilharzia, malaria, and other tropical diseases. It is also sometimes found as a symptom of the irritation which follows the use of cantharides blisters in young children, and it may be caused in some by the external as well as internal use of carbolic acid. In

[1] A. E. Garrod, "Croonian Lectures," *Lancet*, 1908, ii., 1, 73, 142, and 214; and *Inborn Errors of Development*, London, 1908, 41.

moribund babies the sudden occurrence of profuse hæmaturia is often due to thrombosis of one of the renal veins.

Rarely, a child is met with who has more or less constant hæmaturia, dating from early infancy, without any discoverable cause. In these cases some sort of congenital local abnormality of the blood-vessels seems to be present. The children are otherwise healthy, and the hæmaturia is not materially influenced by medicine or by hygienic treatment. In one case of this kind the patient grew up fairly healthy in spite of its continuance and was passed into the army. A curious family variety of the condition has been described by Dr Leonard Guthrie.[1]

Pyuria.—Pus in the urine in girls may come from a vulvar or vaginal discharge. In older children it may, though rarely, be due to renal tuberculosis. In the vast majority of cases, however, pyuria in young children indicates the presence of cystitis, pyelitis, or pyelonephritis from bacillus coli infection.

Cystitis.—This may be of a simple catarrhal variety, or it may be due to a growth of bacillus coli, or some other pyogenic organism, either pure or as a mixed infection.

Simple catarrhal cystitis, due, apparently, to concentrated or ammoniacal urine or to a chill, sometimes occurs in young children. It is rather commoner in boys than in girls, and it is occasionally important as a cause of persistent incontinence of urine. The symptoms may be extremely slight, the microscopical examination of the urine showing only mucous corpuscles, some epithelial cells, and a few leucocytes. The treatment consists in regulation of the diet, the administration of salol,[2] and the careful avoidance of cold.

Cystitis from mixed infection is usually characterised by alkaline or mildly acid urine. It is less common and generally much more troublesome than the form due to a pure culture of the colon bacillus. It usually occurs after an infectious disease such as measles. The treatment consists in careful attention to the general health, along with the administration of acid phosphate of soda sufficient to render the urine acid, followed by urotropin (in doses of 2 to 10 grs. according to

[1] *Lancet*, 1903, i., 1243.

[2] It is extremely doubtful whether salol in medicinal doses has any appreciable antiseptic effect on the urine, but in my experience it has often seemed to produce a good effect on the symptoms.

the child's age) or salol (2 to 3 grs.); washing out the bladder is very rarely advisable. These cases are often extremely obstinate, but the ultimate prognosis is generally good, unless tuberculosis is present. The use of an autogenous vaccine is often recommended, but I have never found it successful in childhood.

Infection of the Urinary Tract by Colon Bacillus.[1]—When a baby's urinary tract is invaded by the bacillus coli we may have, clinically speaking, one of four things—Simple Bacilluria, Cystitis, Pyelitis, or Pyelonephritis, or a combination of these.

(1) *Simple Bacilluria.*—In this there are numerous colon bacilli in an acid urine, which may be cloudy from the number of the organisms, and have an offensive odour, but in which there is no pus, and no symptoms except perhaps an increased frequency of micturition or some incontinence. This condition, which is not at all uncommon in connection with operations on the abdomen, and in any other circumstances in which the general resistance is lowered, as in cases of severe intestinal derangement, is to be treated by alkalinisation of the urine, by salol, and by an occasional dose of calomel. It is also important to give attention to the general health.

(2) *Cystitis.*—This is characterised by the presence of colon bacilli, pus cells, and often blood corpuscles, in an acid urine, increased frequency of micturition, with a varying amount of dysuria, little or no rise of temperature, and no marked appearance of illness or distress. It is a common condition, sometimes met with alone, but often along with diarrhœa. Its treatment is the same as that of pyelitis, by which, if not treated, it is apt to be followed.

(3) *Pyelitis* (*or Pyelo-cystitis*), from bacillus coli infection, is a common and important disease of infancy and childhood. It may set in during apparent good health, but is more often found in states of debility, or as a complication or sequel of bowel derangements. It is four times as common in girls as in boys, because the bacilli easily find their way up the female urethra, while in the male this path of infection is probably impossible. In those cases in which the bacilli pass from the

[1] L. E. Holt, *Arch. Ped.*, 1894, ix., 808; J. Thomson, *Scot. Med. and Surg. Journ.*, 1902, xi., 7; *Quart. Journ. Med.* (Oxford), 1909-10, iii., 251; and *Trans. XVIIth Internat. Congr. Med.* (Sect. of Dis. of Child.), 1913, 107.

bowel into the urinary tract, either straight through the tissues or by the blood-stream, the sexes are more or less equally affected. Pyelitis may occur at any age, but it is seen twice as often in babies under two years as in older children, and it is also usually much more severe in them.

Localising symptoms in these cases are so slight that they often remain unrecognised, because, though the children are obviously very ill, there may be nothing found to account for their condition, except a small amount of pus and bacteria in the urine. Occasionally there has been some incontinence or undue frequency of micturition for a week or two before the acute symptoms set in, but usually no preliminary local symptoms have been noticed.

The onset is generally sudden, the temperature rising rapidly to 101° to 105° F., and assuming a remittent type like that of enteric fever (see Figs. 100 to 104). The patient is drowsy and miserable, sometimes squints, and seems tender all over. She refuses food, often breathes quickly, and usually vomits. In most cases in girls—though scarcely ever in boys—noticeable shiverings or well-marked rigors take place. Less commonly, the child may alarm her mother from time to time by becoming suddenly pale, stiff, and collapsed. These faint attacks should always be enquired about, as they are very characteristic of the condition. In a few of the cases especially in young babies, convulsions occur which sometimes begin as rigors. A considerable degree of leucocytosis (16,000 to 32,000) is generally present.

Local symptoms are either very trivial or apparently absent. There may, however, be colicky pains, some dysuria or frequent micturition, tenderness in one or other loin, and occasionally palpable enlargement of one or both kidneys with pain on pressure. Vulvitis and vaginitis are very uncommon.

The urine, when passed, is opalescent and distinctly acid, and contains a considerable amount of pus and colon bacilli; and on standing a deposit is slow to form. The amount of albumin present is very slight. Microscopic examination of a drop taken from the middle of a specimen of urine—not from the deposit—shows about six to twelve pus cells in a high-power field. It is important, however, to remember that within the first day, or even several days, of the attack few or no pus cells may be found, and yet they may be numerous

a little later. Should one side only be affected, the pus may from time to time disappear for a day or two, owing to the ureter of that side becoming blocked.

The *diagnosis* depends on two things. *First*, on the presence of pus and colon bacilli in the urine along with the severe general symptoms already described; and *secondly*, on the absence of any signs of organic disease outside the urinary tract which could account for the symptoms. In severe sub-acute diseases, such as tuberculous meningitis, pus and bacilli are often found in the urine from a terminal cystitis. On the other hand, acute pyelitis is often mistaken for meningitis, because of the vomiting, squinting, drowsiness, and restlessness which are present. When large quantities of pus and colon bacilli are found in the urine during the early days of life, along with a palpable hypertrophied bladder, this signifies bacillus coli infection of a congenital hydronephrosis—a condition which is always fatal.

In strong children over two years old, the *prognosis* is probably always good. In babies it is generally so; but in them it must be more guarded because they may be so weakened by the urinary disease as to succumb rapidly to broncho-pneumonia or some other complication; also because in them the risk of the kidneys becoming infected is much greater. When the disease is left to nature, recovery takes place in a proportion of the cases, but the mortality is very much higher than in the treated cases. Relapses are common in untreated cases, and also in those which are treated by antiseptics only.

In regard to the *treatment* there are general measures which are important; and also certain alternative lines of special treatment. The former are the *administration of plenty of fluid* and the *regulation of the bowels*. If the child refuses to drink freely, water must be given through a stomach-tube or by rectum. The bowels may be moved by an occasional dose of calomel and, if necessary, by the regular use of phosphate of soda, which has the advantage over other laxatives that it tends to lessen the acidity of the urine.

The special lines of treatment are three in number, namely:—

(1) *The Use of Sera and Vaccines.*—Serum treatment has been recommended by Dudgeon and by various Italian writers. I have had no experience of its use. Vaccines have proved

very disappointing in my hands in children. They are by no means free from serious danger, and seem to be chiefly successful in the acute cases, which may be expected practically always to recover satisfactorily under alkaline treatment. In chronic cases in children I have never found them of any value.

(2) *Antiseptics* given by the mouth may do good in two ways: (*a*) by lessening the infected state of the urine by their bactericidal action in the *alimentary canal;* for example, a dose of calomel sometimes causes a distinct temporary improvement, probably because it lessens for the time the number of bacteria that are leaking into the urinary tract from the bowel. A course of salol (2 to 3 grs., three or four times a day) is sometimes beneficial, alone or in combination with alkaline treatment; though whether its good effect is due to an antiseptic action in the bowel may certainly be questioned. (*b*) *Urinary antiseptics*, such as urotropin, helmitol, etc., which act directly on the bacteria by liberating formaldehyde in the urine, have proved most successful in the urinary infection of enteric fever. In colon bacillus infection in children, however, their action is very disappointing. They occasionally succeed in acute cases of a mild type, but as a rule they are much less successful than the alkaline treatment. Sometimes, however, in protracted cases, urinary antiseptics and alkaline salts may be given alternately with advantage.

(3) The *alkalinisation* of the urine by potassium citrate, or some other alkaline medicine, is much the most convenient and efficacious form of treatment in either cystitis or pyelitis. The aim of this treatment is *to render the urine alkaline* when passed, and to keep it so for a week or two after all the pus has disappeared and all signs of uneasiness have ceased. The dose of citrate required for this purpose varies considerably in different cases. As a rule, in a patient under two years, 60 grs. in the day is enough, and less may suffice; but sometimes the amount has to be raised to 120 grs. or more, before the urine becomes alkaline and the temperature falls. The time the citrate takes to turn the urine alkaline also varies. Sometimes twenty-four hours is enough; often it takes three or four days, but never more than six or seven days. Within a day, or at most two, of the change in reaction, a very great improvement in the symptoms takes place. This can be well seen in the temperature charts (Figs. 100 to 104, p. 383) because, when the fever

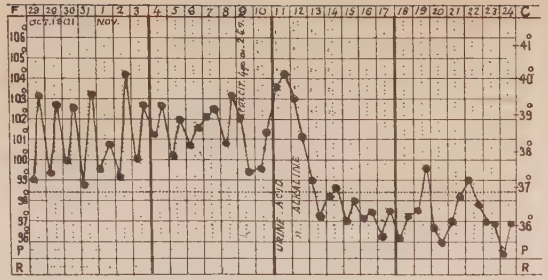


FIG. 100.—Acute Pyelitis, showing effect of alkaline treatment. Girl of 18 months.

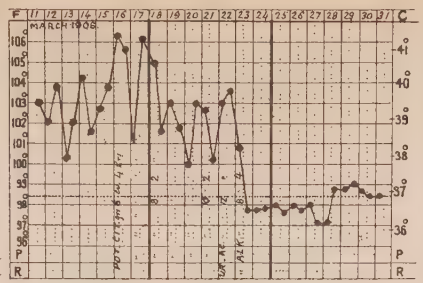


FIG. 101.—Acute Pyelitis, showing effect of alkaline treatment. Boy of 2½ months.

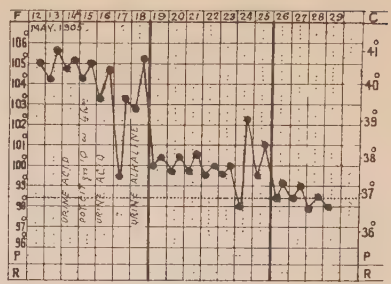


FIG. 102.—Acute Pyelitis, showing effect of alkaline treatment. Girl of 6 months.

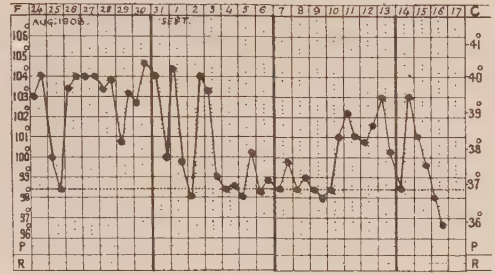


FIG. 103.—Acute Pyelitis, showing effect of alkaline treatment Girl of 19 months.

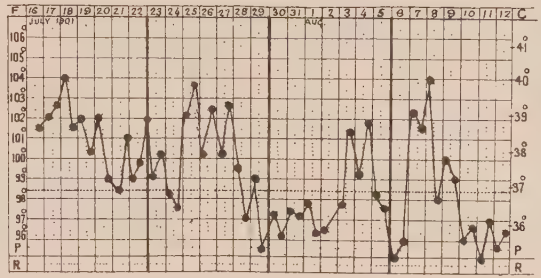


FIG. 104.—Acute Pyelitis, showing effect of alkaline treatment. Girl of 7 months.

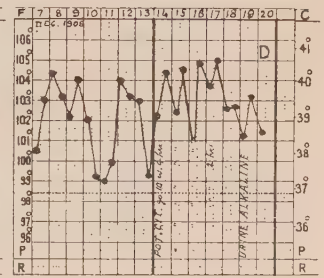


FIG. 105.—Acute pyelo-nephritis, showing absence of effect from alkaline treatment. Boy of 7 months.

lessens, the other symptoms also improve; and any return of other manifestations of the disease—such as an increase of the pus, of the acidity of the urine, or of the general distress—is accompanied by a fresh rise of temperature. Even when large doses of potassium citrate are being given continuously, there is a strong tendency for the urine to become acid again within from three to seven days after it has begun to be alkaline. With this return of acidity the temperature rises and the other symptoms come back (Figs. 102 to 104). These relapses occur in about two-thirds of the cases. Usually they are very slight, but sometimes they are considerable and last for days. Even in the worst of them, steady continuance of the citrate causes a rapid subsidence of the symptoms and the further progress is uneventful.

If the amount of citrate given is not sufficient to turn the urine neutral or alkaline, it has no effect at all in relieving the symptoms, or in lessening the risk of the disease spreading to the kidneys. In a few cases the potassium citrate causes troublesome vomiting. This generally ceases if sodium bicarbonate is given instead.

If the infection has spread to the kidneys, to any extent, no amount of alkalinisation of the urine, and no other treatment, can be expected to do any good. In chronic apyrexial cases of mixed bacillus coli and other infection in older children, alkaline treatment not only fails to do good but seems to be positively harmful.

(4) *Pyelonephritis.*—In a relatively small proportion of the cases of bacillus coli infection, the kidneys become seriously involved and numerous small pyæmic foci form throughout them. Some of these are hæmorrhagic and others necrotic. In some instances, the kidneys seem to have been infected primarily through the blood stream; in others, the disease has probably spread from the pelves.

The temperature chart (Fig. 105) may be somewhat similar to that in pyelitis; but often there is little or no pyrexia, the child being in a state of collapse. The infected organs may sometimes be found much enlarged and tender.

Alkalinisation of the urine and other forms of treatment have no beneficial effect; and, unless the condition is very slight, there seems to be no hope of recovery.

Diabetes Insipidus (*Polyuria*).—This rare disease occurs occasionally in children. It is possibly due to some abnormality in the pituitary gland. The symptoms and course are the same as in adults. The prognosis is much less serious than in diabetes mellitus, and many uncomplicated cases recover.

The *treatment* consists mainly in attention to the general health. Great care must be taken to avoid chills and overexertion, and to encourage the action of the skin by warm clothing and hot baths. To what extent benefit is derived from medicines is doubtful; but cod-liver oil is indicated. Improvement has also sometimes followed the use of ergot and antipyrine. Moffett[1] found that in one child of six years the subcutaneous injection of ½ cub. cm. of pituitary extract, twice daily, reduced the quantity of urine from 7000-8000 to 1500-2500 cub. cm. in the day, and greatly relieved the symptoms. Others have made similar observations.

In one patient, a healthy looking boy of two years, whose symptoms had lasted for several weeks, and who was passing from 7 to 8 pints of urine daily, the continued administration of ergot was accompanied by gradual improvement. Two years later, he was reported to be quite well in every respect.

In another case, a girl of twelve years, after many lines of treatment had been tried with no result and the child was in a dangerously weak state, apparently spontaneous recovery took place; and twenty years later there had been no return of the symptoms.

Glycosuria.—Sugar is rarely found in the urine in children; with care, however, its presence in small amount may often be demonstrated in cases of alimentary intoxication in infancy. When it occurs in any considerable quantity, without a distinct alimentary cause, its presence is of grave significance, as it generally indicates diabetes mellitus. Very rarely, a degree of glycosuria occurs as a family disease, and seems to have little or no bad effect on the general health. Sugar may be detected in the urine in a large proportion of cases of tuberculous meningitis, shortly before death (Still); also in some cases of tumours in the pancreas and pituitary gland.

[1] *Med. Rec.*, 1917, xcii., 487.

Diabetes Mellitus.

Diabetes may occur at any age. Fortunately it is rare in young children, for in them it is a very fatal disease, and the younger the child the more acute are the symptoms. Sometimes it runs its course in a few weeks, and it rarely lasts more than six months. I know of no authentic cases on record in which permanent recovery took place in a child under four years old. In older children the outlook, though serious, is not so invariably unfavourable. In them the symptoms often last for years; and, under careful treatment, may occasionally recover.

Symptoms.—The outset of the disease may be sudden, and sometimes it sets in after an accident or a feverish illness; but generally the onset is gradual. The child loses flesh, his skin becomes dry, he is fretful and changed in disposition, and complains of weariness and muscular weakness. Sometimes an odour of acetone is noticed in the breath, and there is often, though by no means always, great thirst and a copious flow of urine which causes incontinence. Constipation is generally present, and the knee-jerks are lost. If diarrhœa sets in, this is an ominous symptom as it is apt to be followed by acidosis.

The glycosuria, in some cases at least, is intermittent at first. I have known more than one instance, in young children, in which the first specimen of urine examined showed no sugar at all, although the child had characteristic general symptoms, and later analyses revealed a high degree of glycosuria.

As the disease progresses, there is a strong tendency to the occurrence of boils and other pyogenic affections. Children are especially prone to have diabetic coma, and this is the usual cause of death, but occasionally it is due to pneumonia.

Treatment.—The child's general hygiene must be carefully regulated. He should be very warmly clad, and have plenty of open-air exercise, but always short of fatigue. A daily action of the bowels should be secured.

In young children severe restriction of the diet is so irksome and distressing, that it usually has to be given up. Diminution of carbohydrates must be carried out very cautiously for fear of setting up acidosis. A course of oat-

meal food is recommended for children by van Noorden. It should be given for several days at a time—no other starchy food being allowed with it. It is said sometimes to increase the carbohydrate tolerance to an unexpected degree, and to diminish acetonæmia.

Generally no drugs, apart from laxatives, are advisable. When the carbohydrates in the food are being reduced, alkalies should be given freely; and if signs of threatening coma appear, large doses of bicarbonate of soda ($\frac{1}{2}$ drm. to 1 drm. every hour) are necessary (p. 455).

During the last year or two, excellent results have been obtained in adults by the "Allen" treatment.[1] This consists in starving the patient "until sugar has been absent from the urine for twenty-four hours, then finding the carbohydrate tolerance whilst the diet contains very little protein and practically no fat. When the carbohydrate limit has been found, the protein limit is determined, and then the required amount of energy is made up with fat, provided the addition of fat does not lead to the appearance of sugar in the urine nor any evidence of acidosis" (O. Leyton).

In one instance, a child of four years, a patient of my colleague Dr J. W. Simpson, recovered under this form of treatment and still remains well after several years; and in several older childen I have known it to yield surprisingly good results. The severe nature of the restrictions in diet, however, make the Allen treatment difficult to apply in early life.

[1] The details of this treatment are somewhat elaborate and cannot be given here. They will be found fully described in Dr F. M. Allen's own papers, *Amer. Journ. Med. Sci.*, 1915, cl., 480; *Boston Med. and Surg. Journ.*, 1915, clxxii., 241; or in Dr O. Leyton's little book on *The Modern (Allen) Treatment of Diabetes Mellitus*, London (Adlard), 1917.

CHAPTER XIX

DISEASES AND DEFECTS OF THE GENITAL ORGANS

Male.

Adhesion of the Prepuce to the Glans Penis.—In the normal new-born child the inner surface of the prepuce is more or less adherent to the glans. When the adhesions are more extensive and persist longer than usual, the opening of the prepuce often looks smaller than it really is, and the condition is apt to be mistaken for phimosis and to lead to unnecessary operation.

In such cases, when the adhesions are separated with a probe, the foreskin is found to retract quite freely. If the child is not suffering from any local irritation, however, the adhesions may safely be left alone, as they will probably do no harm and will always disappear in time. If they are giving rise to accumulation of smegma, and especially if balanitis occurs, the adherent surfaces should be gently separated, and the mother or nurse instructed to draw back the prepuce daily for a few weeks and apply a disinfectant ointment. If, after separation of the adhesions, satisfactory retraction of the prepuce is still impossible, the condition is one of phimosis and calls for further treatment.

Phimosis.—Abnormal narrowing of the opening of the prepuce occurs in very varying degrees. When it is at all extreme, it hinders the free passage of the urine and often leads to balanitis and dysuria. Generally, the narrowing is a congenital defect, but occasionally it results from temporary inflammation of a normally wide though redundant foreskin.

Neglected phimosis causes many troubles. Sometimes it sets up retention of urine; more frequently, perhaps, it is

a cause of enuresis; and it often results in constant local discomfort which sometimes leads to sleeplessness, and may predispose to masturbation. In rare cases it may be to blame for reflex contractions of the lower limbs or fits.

Treatment.—Dilatation of the prepuce has been strongly recommended by some, and it sometimes succeeds in the milder cases; but it is a troublesome proceeding and often fails. Early circumcision is generally much to be preferred.

Circumcision, when necessary, should be done early—preferably within the first few weeks of life. The operation need not be described here, but it may be said that enough of the prepuce should be left to cover the corona. The corona glandis is a delicate structure, and it is certainly a mistake to remove unnecessarily the admirably efficient provision which Nature has made to guard it from friction and injury.

While, in suitable cases, circumcision is a necessary and harmless operation, it is difficult to sympathise with those who recommend that it should be performed indiscriminately on all male infants. A great deal too much has often been claimed for it. In beginning the treatment, in cases of obstinate masturbation, circumcision may prove a useful adjunct to other measures as, by the pain it causes, it ensures a complete cessation of the bad habit for a short time. It has, however, no permanent, or even long-continued effect on the habit; and in some cases it even favours its beginning and continuance. Circumcision is also disappointing in its effects as a treatment of enuresis. It certainly stops it in some cases, but in many I have seen the incontinence aggravated by the operation; and, in not a few instances, enuresis has begun for the first time shortly after circumcision had been performed for other reasons.

Balanitis is often predisposed to by a neglected phimosis. It may be accompanied by considerable purulent discharge, and some pain on passing water. Generally, the inflammation subsides rapidly when the affected cavity is frequently syringed with normal saline solution or boracic lotion. If the balanitis goes on recurring, circumcision is indicated; but it should not be done while the parts are inflamed. An *ulcer on the glans penis* round the entrance to the meatus is a common result of the irritation of ammoniacal urine on the diapers in little boys, especially in those who have been circumcised (p. 374).

It is often slow in healing, and occasionally extends into the meatus and leads to a cicatricial contraction there. It may also be a cause of incontinence. Ulcers of this kind should be dressed with boric ointment and protected from friction and wet diapers. If, as often happens, the ulcers refuse to heal with this treatment, the meatus should be slit up, and stitches put in to prevent contraction on healing.

A Congenital Narrowing of the Meatus is an occasional cause of enuresis. It requires gradual dilatation.

Urethritis is sometimes due to gonococcus infection, but may also arise from extension of the inflammation into the urethra in cases of simple balanitis. It rarely occurs in a painful form in cases of bacillus coli infection of the urinary tract.

I have seen one case of what seemed to be **Prostatitis** in a boy of ten, which recovered completely. Generally, in the rare cases in which children have prostatic enlargement, it is caused by malignant disease, but it may be due to tuberculosis.

Other Malformations, such as hypospadias, extroversion of the bladder and milder degrees of epispadias, are mainly of surgical interest. Extroversion of the bladder is best treated by transplantation of the ureters into the rectum. The result of this operation is often satisfactory in spite of the risk of subsequent bacillus coli infection of the urinary tract.

Delayed Descent of the Testicles.—Normally the testicles pass down the inguinal canal during the ninth month of intra-uterine life. Not uncommonly, however, we meet with children in whom this process has been delayed, so that one or both sides of the scrotum are empty at birth. When this is so, the testicle often descends during the first month or two without treatment; and this may occur any time up to puberty or even later. If it is delayed beyond the first year, the testicle is accompanied by a hernia in the large majority of cases. Sometimes the organ becomes arrested in the inguinal canal, and in rare instances it goes astray and is found in the groin or perineum. Not very uncommonly, one or both of the testicles remain permanently in the abdomen (*Cryptorchism*).

The recognition of non-descent of the testicle is not always easy on the first examination, as the organ may be temporarily retracted into the inguinal canal to such an extent that it

is difficult to make out. A careful examination after application of heat to the part will usually, however, make the diagnosis clear.

Treatment.—When the descent of the testicle is incomplete, it may sometimes be assisted by repeated careful attempts, made several times a day, to bring it down by manipulation; and an operation should not be decided on hurriedly unless unpleasant symptoms are being caused. The treatment, however, is a matter for the surgeon. As the testicle in these cases is generally sclerosed and functionless, it is often well to have it removed. In deciding about its removal the question of the effect of its internal secretion has to be borne in mind.

Hydroceles of various kinds are often found, especially in young infants, and they rarely cause much trouble. Many cases recover without treatment, but when the condition persists surgical treatment is necessary.

Acute Orchitis. — The common form of orchitis due to mumps is practically unknown in children under twelve, and rare under fourteen. It sets in about the end of the first week, at the time when the parotid swelling is disappearing, and it is often accompanied by severe general disturbance with high temperature and much local pain. It not infrequently results in atrophy of the affected testicle. The treatment consists in hot fomentations, and in support of the testicles by pads of cotton-wool or by sticking-plaster across the thighs.

Chronic Orchitis is not very uncommon in babies with congenital syphilis. It is generally bilateral and is often complicated by epididymitis and hydrocele. The testicle is enlarged, hard, and painless. The condition usually seems to recover completely under specific treatment.

Tuberculous affections of the testicle and epididymis occur occasionally, especially in infants. They may appear as part of a generalised infection, or, usually in older children, the disease may be limited to the genito-urinary tract. Generally both testicles are affected. When suppuration occurs, as often happens, the diseased parts should be excised. In cases of tuberculosis of the testicle, the prostate should always be examined, as it is frequently also affected.

Tumours of the Testicle may be congenital or acquired. The former may be dermoid cysts, myomata, or lympho-sarcomata.

Non-congenital tumours of the testicle occur mostly in older children. They are usually round-celled sarcomata of a very malignant character, which require excision as early as possible and are very apt to recur.

Female.

The Mammæ.—All new-born babies, boys as well as girls, have a secretion of milk in their breasts. The fluid secreted resembles woman's milk in composition, and, under the microscope, looks like colostrum. The secretion begins in intrauterine life, but swelling of the breasts is usually only noticed some days after birth. It goes on increasing until about the ninth day, and then slowly diminishes. About twenty days after birth, it has, in most cases, entirely disappeared. Occasionally it lasts for many weeks, and I have seen greatly enlarged and secreting mammæ in a child of four months.

FIG. 106.—Mammary Abscess. Baby of 6 weeks.

The swollen breasts should be carefully protected against injury, and kept surgically clean. Occasionally an abscess forms in one or both of them through the entrance of pyogenic organisms (Fig. 106). These abscesses generally heal rapidly when opened in the usual way. If the child is sickly and ill-cared for, however, serious sloughing may occur.

Girls between nine and twelve years old occasionally suffer from a condition known as *irritable breast.* One of the mammæ enlarges and becomes tender for a time, and after an interval the other may be similarly affected. The condition is harmless and requires no special treatment.

Congenital Absence of the Breast is found on the affected side in a considerable proportion of cases of "unilateral pectoral defect" (p. 690); and, when present, the pectoral muscles and costal cartilages should always be carefully examined. Generally the nipple remains in a rudimentary form, but, in rare instances, no trace of it is present (Fig. 188).

Adhesions of the Prepuce of the Clitoris are often present, and usually give rise to no symptoms; but some writers have attributed many reflex nervous symptoms to their presence. Circumcision may, from the pain it causes, be useful in beginning the treatment of obstinate masturbation, but the effect is not lasting.

Not very rarely, the opening of the vagina is closed in young infants or older girls by a simple epithelial **adhesion of the labia minora.** This condition is a trivial one, and can be put right at once by gently separating the parts with a probe.

Congenital Prolapse of the Uterus is a rare condition, which occasionally occurs as a complication of spina bifida in the lumbo-sacral region along with rectal ectropion and double club-foot. The children always die within a few weeks.[1]

Vaginal Hæmorrhage is the least serious of the manifestations of the hæmorrhagic disease of new-born children (Chapter XX.). Usually it sets in within the first six days and rarely after the twenty-first. It only lasts for a few days and is never serious. It is probably connected with the congestion of the pelvic veins, which results from the cessation of the circulation in the umbilical arteries on ligature of the cord. A similar discharge of blood from the rectum may accompany it. It is generally a trivial condition requiring no special treatment.

Precocious Menstruation may occur at any age from eighteen months onwards, and the discharge may recur at monthly intervals. It may be accompanied by other indications of premature sexual development, and is sometimes a symptom of cortical hypernephroma.

Vulvo-vaginitis.—A purulent discharge from the vulva may be simply catarrhal in origin, but more frequently it is due to a gonococcal infection.

Simple Catarrh of the Vulva and Vagina is not uncommon. It may arise from dirt, friction, or thread-worms, or from the contact of irritating urine or fæces; and it is especially apt to occur after such debilitating diseases as measles. It usually recovers after a week or two of douching with boric lotion and the application of a mild mercurial ointment.

[1] J. W. Ballantyne and J. Thomson, *Amer. Journ. Obstet. and Dis. Wom. and Child.*, 1897, xxxv., 2.

Gonorrhœal Vulvo-vaginitis is an exceedingly troublesome and obstinate complaint which may be met with at any age. It is nearly always acquired accidentally from contact with infected bed-clothes, sponges, or thermometers.

In America it has been found that the disease is so extremely contagious that, whenever a case is admitted into a ward, others always occur within a few days in spite of the most careful precautions.[1] In this country, the tendency to spread in this way seems not to be so great, although it is still considerable.

In some cases the discharge is profuse, in others it is very scanty. Young babies usually show no sign of local discomfort, but, in older children, dysuria is often complained of. The distribution of the disease varies in different cases, sometimes the cervix is much affected and the vagina comparatively free. It is rare for the disease to spread to the tubes or to the pelvic peritoneum. The main complications are conjunctivitis, arthritis, and teno-synovitis (p. 76); endocarditis and peritonitis are less frequent.

Treatment.—The child should be kept in bed, the general health attended to, and local remedies applied. The local treatment must be most carefully and assiduously carried out, as the disease is very intractable. Good results have been reported from the use of a detoxicated vaccine; but, generally, the measures found most efficacious consist in douching with antiseptic lotions, swabbing with stronger solutions of antiseptics, and occasionally the insertion of pessaries.

Copious douching of the vagina and superficial parts with such mild antiseptic lotions as a 1 per cent. solution of protargol, 1 in 10,000 hydrarg. perchlor., saturated solution of boric acid, and 1 in 300 lactic acid lotion, is certainly beneficial. Probably, however, the good result depends fully more on the mechanical action of the lotion in cleansing the parts than on any antiseptic effect on the gonococci. The douching should be repeated four times a day. Another useful measure is the filling of the vagina with pure eucalyptus oil and keeping it in for a minute or two by holding up the child's legs and pelvis.

If, on examination of the deeper parts with the urethroscope or speculum, localised areas of severe inflammation are dis-

[1] L. Emmett Holt, *New York Med. Journ.*, 18th and 25th March 1905, 521 and 589.

covered, these should be swabbed with a 10 per cent. solution of protargol, or a 1 per cent. lotion of lactic acid, on a dressed probe.

It is generally advisable to alternate the use of different antiseptics from time to time. In convalescent cases, lactic acid pessaries are sometimes helpful. A weak mercurial ointment should be applied to the external parts.

When the treatment is thoroughly carried out, recovery may take place in from three to six weeks; but often, in spite of great care and trouble, the disease lasts for months.

CHAPTER XX

ON THE BLOOD AND ITS DISEASES[1]

The Blood in Infancy and Childhood.

DURING the first four years or so of life the child's blood differs from that of the adult in various ways.

At birth the blood is more concentrated, the hæmocytes averaging 5,500,000, and the total leucocytes 20,000 in the cubic millimetre, while the hæmoglobin is about 110 per cent. At this stage the red corpuscles show a tendency to inequality in size, and during the first few days some nucleated red cells are normally present. Among the leucocytes, polynuclear forms predominate, and the lymphocytes are relatively few in number.

This state of things does not last long (Fig. 107). Within the first fortnight the number of the hæmocytes has fallen to 5,000,000 in the cubic millimetre, at which figure it remains through life. The number of the total leucocytes diminishes until it reaches 10,000 per cubic millimetre at the end of the first week, and then rises again steadily to 15,000 by the end of the sixth month.

From this age till the end of the fourth year, any leucocyte count between 10,000 and 15,000 per cubic millimetre may be regarded as not abnormal. The average adult number (8000) is reached about the time of the second dentition. The proportion of the different forms of leucocyte also changes. During the first week of life the polymorpho-nuclears rapidly diminish and the lymphocytes gradually increase in number (Fig. 108).

[1] In the preparation of this chapter the author has made much use of Dr J. S. Fowler's papers, "On the Diagnosis and Prognosis of some Forms of Blood Disease in Infancy," *Internat. Clinics*, 1901, 135, and "On the Splenic Anæmia of Infancy," *Brit. Med. Journ.*, 6th September 1902, ii., 694; and of Dr Robert Hutchison's Goulstonian Lectures, *Lancet*, 7th, 14th, and 21st March 1904, i., 1253, 1323, and 1402.

The proportion of the hæmoglobin falls steadily from birth until it is only about 70 per cent. at the end of the sixth month. It then remains stationary for about eighteen months, and after

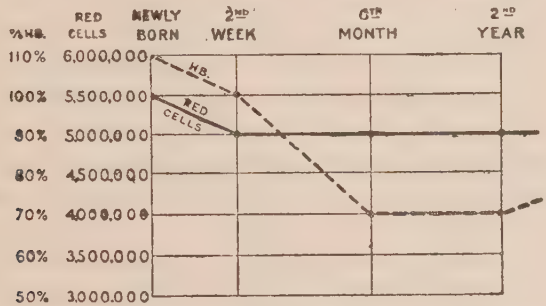


FIG. 107.—Proportion of Hæmoglobin and Red Corpuscles throughout infancy (R. Hutchison).

that rises slowly and gains the normal level about the sixth year.

We see from the above that the main normal characteristics of the blood in early childhood are the high absolute number of

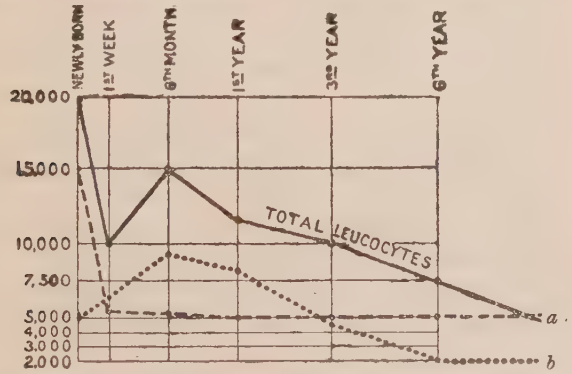


FIG. 108.—Absolute number of Leucocytes per cubic millimetre at different ages. *a*, Polynuclears. *b*, Lymphocytes. (R. Hutchison.)

non-granular leucocytes and the relatively low percentage of hæmoglobin.

Leucocytosis.

In childhood, as in later life, the condition of the blood as to leucocytosis is sometimes of great assistance in the diagnosis of

septic and inflammatory states as well as in blood diseases. It is also of some value in prognosis under certain circumstances.

In a few diseases, such as tuberculosis, influenza, mumps, measles, rötheln, enteric, and malaria, there is usually no increase of the leucocytes *in uncomplicated cases*. In many cases of tuberculous meningitis, however, there is a very considerable increase. In nearly all the other infective diseases there is a decided polymorpho-nuclear leucocytosis. This is characteristic, for example, of diphtheria, scarlet fever, erysipelas, acute bronchitis, pneumonia, empyema, purulent meningitis, suppurative appendicitis, tonsillitis, pharyngitis, cystitis, pyelitis, nephritis, gastro-enteritis, peritonitis, endocarditis, pericarditis, acute rheumatism, osteomyelitis, and septicæmia—also of severe rickets and various neoplasms.

The leucocytosis of whooping-cough is peculiar and may be of importance as an aid to diagnosis in doubtful cases.[1] It is present in the catarrhal stage and during the first three weeks of the paroxysmal cough. The number of the white cells varies from 10,000 to 85,000, and often reaches from 20,000 to 30,000. The main characteristic of the blood-count is that, while the polymorphs are approximately normal in number, the lymphocytes of all kinds are always increased, either absolutely or relatively, and usually to a very considerable degree.

When whooping-cough is complicated by bronchitis or broncho-pneumonia, the leucocytosis is, of course, greater than in uncomplicated cases; it may even amount to 150,000. When marked lymphocytosis, or an unusually high degree of ordinary leucocytosis, is met with in a case of broncho-pneumonia it should always suggest the probable presence of whooping-cough. A lymphocytosis is also characteristic of congenital syphilis.

The leucocyte count may throw light on the diagnosis of many other obscure conditions. It may help us, for example in distinguishing a case of typhoid from one of appendicitis, septicæmia, or purulent meningitis, or an appendicitis from renal colic, acute indigestion, or typhoid.

The absence of the usual leucocytosis in an infectious disease may be due to the attack being a mild one, or to the patient's low vitality. In the latter case, it implies a grave

[1] J. Frank Crombie, *Edin. Med. Journ.*, Sept. 1908, 222.

prognosis. In a severe attack of pneumonia a high degree of leucocytosis is of good omen.

Eosinophilia.—In children, as in adults, eosinophiles constitute from 2 to 4 per cent. of the leucocytes in normal blood. A decided increase in their number is caused by the presence of animal parasites in the bowel or elsewhere. Eosinophilia is also met with in certain skin diseases such as urticaria pigmentosa, dermatitis herpetiformis, and various bullous eruptions. A great increase in the eosinophiles also occurs in asthma and in other morbid conditions depending on anaphylaxis.

Anæmia.

Anæmia is not uncommon in children, but as a symptom calling for direct treatment it is much less frequently met with than in young adults. Most pale feeble-looking children are not benefited by the use of iron, and many of them are made worse by it. Their pallor is often largely a vasomotor phenomenon due to dyspepsia; and, as the iron tends further to derange the digestion, it does more harm than good. Delicate children, who have been taking Parrish's Syrup or some other chalybeate preparation for months without improvement, often gain at once in appetite, colour, and brightness, when the iron is changed for an ordinary alkaline and bitter tonic. In some cases of anæmia and dyspepsia, however, the indigestion is secondary to the state of the blood. In these, and in cases of anæmia in which the digestion is not impaired, iron is of great service.

Congenital Anæmia with Jaundice.—Apart from the polycythæmia which is characteristic of congenital pulmonary stenosis and some other cardiac malformations, no congenital abnormalities of the blood have been generally recognised. In recent years, however, congenital family cholæmia (p. 310) has been described as belonging to this category, and Hill Buchan, M'Gibbon, and Comrie[1] have recorded a series of cases of congenital anæmia with jaundice, which seem to represent another distinct type of congenital blood disease. In this condition, which sometimes occurs in several members

[1] Hill Buchan and M'Gibbon, *Scot. Med. and Surg. Journ.*, Sept. 1906, xix., 233; and Hill Buchan and Comrie, *Journ. Path. and Bacteriol.*, 1909, xiii., 398.

of a family, the infant shows at birth great pallor of the skin, with a degree of jaundice and slight enlargement of the liver and spleen. During the first few weeks, both these organs continue to enlarge, the jaundice persists with pale motions and bile-stained urine, and a basic cardiac murmur is heard. The blood shows a low percentage of hæmoglobin, fewer hæmocytes, and many nucleated red cells of all varieties; there is a moderate degree of leucocytosis.

A characteristic and extraordinary feature of the disease is the occurrence in the circulating blood of phagocytosis of the red cells by the leucocytes.

In most cases, the disease is rapidly fatal, but complete recovery sometimes takes place. In those that recover, the enlargement of the liver and spleen subsides within a few weeks, and the condition of the blood rapidly becomes normal. In some fatal cases, obstruction of the bile-ducts has been found. The disease is an extremely interesting one and requires further investigation, especially as to its relations to such other conditions as congenital obliteration of the bile-ducts and congenital family cholæmia.

Simple Primary Anæmia. — Occasionally we see young children who are suffering from a type of anæmia which closely resembles chlorosis. There is no obvious cause for the bloodlessness, but the children are extremely pale and often have hæmic murmurs; there is little or no enlargement of the spleen. The blood shows a small percentage of hæmoglobin, with a relatively slight diminution in the number of the red cells. The lymphocytes may be somewhat increased, the polymorphs being diminished in number; and, if the patients are young babies, a number of nucleated red cells may be found. If the condition of the blood only is taken into account, these cases may be mistaken for leukæmia. Severe cases of this type of anæmia are uncommon, but occasionally the children look very ill and a considerable amount of œdema may even be present. Anæmia of this type may be met with at any age—in babies under a year old as well as in older children. The treatment is most satisfactory, as the child rapidly and completely recovers when some preparation of iron is given.

Pernicious Anæmia.—In its typical form, pernicious anæmia is a very rare disease indeed in young children. Cases which

resemble it are occasionally seen; but it is generally very doubtful whether they are true instances of the disease. Sometimes the diagnosis is disproved by the recovery under careful dieting and iron. A definitely bad prognosis should certainly never be given in such a case until these measures have been given a careful trial.

Aplastic Anæmia is also very rare in childhood and cannot be recognised with certainty during life.

Secondary Anæmia.—Young children are especially prone to develop secondary anæmia from all sorts of causes. Their red corpuscles seem to be more readily destroyed than those of adults, and are only slowly replaced. The marrow at this time of life is, under ordinary circumstances, so fully occupied in the manufacture of hæmocytes that it is not capable of meeting special emergencies, as it does in adults, by a special hyperplasia; and a diminution in the number of red cells with a fall in the hæmoglobin readily takes place on slight occasion. At the same time poikilocytosis, and a few nucleated red corpuscles may be found. It is the presence of these last-named abnormalities which form the characteristic hæmatological features of the secondary anæmias of early life.

Secondary anæmia may be due to too little iron and protein in the diet, or to lack of sunshine and fresh air. Attacks of acute infectious disease of any kind are very prone to cause it, and the rheumatic poison seems to have a specially bad effect on the blood. Syphilis, tuberculosis, malaria, chronic diarrhœa, and septic conditions from bad teeth, may all lead to severe secondary anæmia.

Leukæmia.—*Myelogenous leukæmia* is seldom met with in childhood, but a small number of typical examples of the disease have been recorded. They are characterised by a low hæmocyte count and high leucocytosis—100,000 to 500,000—of which, as many as half may be myelocytes. The spleen is enormously enlarged, and usually the liver also. The children do not seem very ill at first and they often live for six or eight months.

Instances of *lymphatic leukæmia* are not very uncommon. In these the so-called "large lymphocyte" is the predominating form of cell found in the blood; and in young children nucleated red cells and other abnormal corpuscles are usually also present.

Mixed forms of leukæmia, in which both myelocytes and lymphocytes are present in large numbers, are specially characteristic of early childhood. It seems possible, as Fowler has pointed out, that "this may be the form which splenomedullary leukæmia assumes in infancy."[1]

The exact duration of lymphatic leukæmia, as indeed of most blood diseases, is difficult to determine, owing to the very insidious onset. It certainly, however, runs a much shorter course in children than in adults; and is also much more rapidly fatal than the myelogenous type. Generally its duration is a matter of a few weeks or months. Epistaxis and other forms of hæmorrhage are sometimes among the earliest symptoms. In other cases, the tendency to bleeding only appears towards the end. Ulceration of the buccal mucous membrane sometimes occurs. Some glandular enlargement may be found, and the spleen is generally, though not always, greatly increased in size. I have met with several cases in which there was no actual increase in the number of the leucocytes, although the post-mortem examination showed clear evidence that the condition was one of lymphatic leukæmia. In most cases, however, there is a large leucocytosis.

The *treatment* of leukæmia is most unsatisfactory. Temporary improvement sometimes follows the use of increasing doses of arsenic along with fresh air, and careful dieting and nursing. The application of X-rays causes a striking diminution in the size of the spleen; but it has no permanently good effect on the disease.

Chloroma.—Chloroma is a rare form of atypical lymphoid leukæmia, which is regarded by some authorities as a primary new growth of the bone marrow. It is characterised by the formation of tumours of a peculiar greenish colour, which are found chiefly in the orbits and on other parts of the skull, over the long bones, and in certain of the viscera.[2]

In typical cases it gives rise to a very characteristic appearance of the face, which is well seen in Figs. 109 and 110. A considerable proportion of the reported cases have occurred in children. It is quite incurable and the illness usually lasts for six to eight weeks. The orbital swellings

[1] J. S. Fowler, *Intern. Clinics*, 1901, 135.

[2] G. H. Melville Dunlop, *Brit. Med. Journ.*, 1902, i., 1072.

of chloroma are sometimes mistaken for sarcomata, or for the metastases of malignant medullary hypernephromata.

Splenic Anæmia of Infancy.—The most characteristic disease of the blood in infancy is infantile splenic anæmia. Whether it represents a separate disease, or is merely a form of secondary anæmia, need not be discussed here.

The *changes in the blood* are characteristic. The red corpuscles are diminished in number, but not very greatly (2,500,000 to 3,000,000). They vary considerably in size, and there is usually a slight degree of poikilocytosis. Nucleated red cells are present sometimes in large numbers—generally

FIGS. 109 and 110.—Chloroma. Boy of 5 years. (Dr Melville Dunlop's case.)

they are normo-blasts, but megalo-blasts are also found. A moderate degree of leucocytosis is usually present (20,000 to 60,000 per cubic millimetre at an age when 12,000 to 14,000 is about the normal number). There are many transitional forms of white cells; indeed, the chief feature of the leucocytosis is its polymorphous character. There are always a few myelocytes present.

The *symptoms* usually set in gradually and are somewhat indefinite at first. There is generally some degree of wasting, and often, if the child has been much in the open air, a peculiar brownish yellow pallor of complexion. The spleen is very big, often reaching to the pelvis. The liver is also commonly enlarged. The lymphatic glands are little, if at all, increased in size. Hæmic bruits are common. Attacks of

bronchial and intestinal catarrh are frequent, and irregular rises of temperature are characteristic. In the later stages of those cases which do not do well, there is a tendency to hæmorrhage. Rickets is almost always present, and the cranial bones are often much thickened and bossy. The disease is apt to occur in syphilitic and otherwise weakly children. It is curiously frequent in twins. I have seen more than a dozen instances of this. The disease is commonest between the tenth and eighteenth months of life, but it may occur any time between six months and three and a half years.

The *prognosis* in cases of the splenic anæmia of infants depends a good deal on the stage at which the patient comes under treatment and the degree to which measures for the improvement of his general health can be satisfactorily carried out. Many cases recover completely. If petechial hæmorrhages have begun to appear, the prognosis is bad.

The main part of the *management* of these cases lies in the improvement of the general health by means of dietetic and hygienic measures, and especially in the thorough treatment of rickets or syphilis if either is present. Arsenic may sometimes do good, but iron is not often of much benefit.

Purpura.

Purpura is a common symptom in childhood and, as in adult life, it occurs under a great variety of conditions. It may be either symptomatic or idiopathic.

(*a*) **Symptomatic Purpura.**—In young children purpuric symptoms are met with in cases of severe jaundice from any cause, in scurvy, in leukæmia, and in various other forms of anæmia with enlargement of the spleen, in syphilis, in septic conditions of many kinds, and in severe types of most of the acute infective diseases, including rheumatism and epidemic cerebro-spinal meningitis. They also occur in poisoning with various drugs, notably iodide of potassium in susceptible individuals, and in cachectic conditions generally, whether due to tuberculosis, diarrhœa, atrophy, or other diseases.

The purpura which accompanies severe diarrhœa[1] is of especial interest. It is not at all uncommon in cachectic

[1] Voelcker, *Trans. Med. Soc. Lond.*, 1905, xxvii., 33; H. D. Rolleston and Molony, *Proc. Roy. Soc. Med.*, 1911, v., No. 2, 54.

children under twelve months. The front of the abdomen and the lower part of the thorax are the parts mainly affected. It is a late, and usually an ominous symptom. I have, however, had several cases which recovered although the purpuric eruption had been extensive.

Subcutaneous hæmorrhages from mechanical causes are sometimes met with in cases of epilepsy, and they are common in whooping-cough, especially in the eyelids and under the conjunctiva.

The *treatment* of symptomatic purpura is that of the original disease.

(*b*) **Idiopathic Purpura.**—Cases of ordinary idiopathic purpura may be described under three headings, according to the severity of their symptoms:—

1. *Purpura Simplex*, in which the eruption is accompanied by very slight general disturbance, with or without articular pains, but by no hæmorrhages from internal organs. There is usually no rise in temperature, and the symptoms last only for a week or ten days.

2. *Purpura Hæmorrhagica* (Morbus Maculosus of Werlhof).—In this there are also hæmorrhages from various mucous surfaces—epistaxis, hæmoptysis, hæmatemesis, or hæmaturia, with or without general symptoms; and the patient may die from these, or from intracranial bleeding. There is usually a slight degree of fever.

3. *Purpura Fulminans*, in which the same manifestations occur in an extremely severe degree, and which is generally rapidly fatal with symptoms of collapse. Cases of suprarenal hæmorrhage are sometimes mistaken for this disease.

In purpura fulminans all treatment is useless; and in the other forms the influence of drugs is disappointingly small. Ergot, hamamelis, turpentine, gelatine, calcium salts, and adrenalin have all been tried. It is certainly advisable to begin the treatment by the administration of a mercurial purge. If the child has been underfed, a generous diet is indicated. It is doubtful, however, whether in ordinary cases a change in the food has any effect on the purpura. The occasional injection per rectum of anti-streptococcal serum (10 c.c.) has been recommended[1] and has in some cases a markedly beneficial effect.

[1] Soltau Fenwick and Porter Parkinson, *Med. Chir. Trans. London*, 1906, lxxxix., 197.

Ordinary horse-serum has been suggested as an economical substitute for this, but in my experience has less effect.

The most interesting and important varieties of purpura in childhood are "Henoch's purpura," hæmophilia, and the hæmorrhagic disease of new-born children.

Henoch's Purpura.—This name is given to a type of purpura which is mostly seen in children, and is especially important owing to the frequency with which it is mistaken for intussusception and other forms of intestinal obstruction, as well as from its pathological interest.

Its main *symptoms* are acute abdominal pain, with tenderness over the colon, vomiting, and either bloody diarrhœa or constipation. There are also swelling and pain of the joints, subcutaneous hæmorrhages, and bleedings from mucous surfaces. Although all these clinical features are generally present, they may be either absent or so slight as to be readily overlooked. Two other points are important in the matter of prognosis—namely, that the attack is apt to be repeated after a varying interval; and that acute nephritis not infrequently occurs, and is often fatal.

Owing to the severe abdominal symptoms and the slightness of the subcutaneous and other hæmorrhages, Henoch's purpura is frequently mistaken for acute appendicitis or intussusception. Generally, however, the diagnosis is not difficult, if the facts of the case have been carefully investigated. Occasionally the resemblance to intussusception is increased in a most perplexing way, owing to the occurrence of hæmorrhage into the intestinal wall which gives rise to a palpable tumour. Some cases have also been reported in which such an extravasation has led to a secondary intussusception.

The relations of this form of purpura to such diseases as angio-neurotic œdema, urticaria, and erythema multiforme are close and interesting.[1]

The *treatment* is mainly expectant, and consists chiefly in opium and the application of an ice bag to the abdomen, during the acute attacks. As the purpura in these cases may be secondary to a bowel lesion which results in septic absorption, it is desirable that special attention should be given to the state of the alimentary canal during the intervals between the

[1] Osler, "The Visceral Lesions of Purpura and Allied Conditions," *Brit. Med. Journ.*, 1914, i., 517.

attacks. The use of rectal injections of anti-streptococcal serum is sometimes beneficial in this as in other forms of purpura.

Hæmophilia.

It is said that hæmophilia manifests itself before the end of the second year in from 60 to 70 per cent. of the cases; but it is a striking fact that hæmophilic infants do not seem to suffer more frequently than other babies from umbilical hæmorrhages, cephalhæmatomata, or melæna neonatorum. It is later, after circumcision, division of the frænum linguæ, or abrasion of the gums, that the tendency to bleeding first appears. The patients are nearly always boys, and the disease is transmitted through the mothers only. A history of a family tendency to bleed excessively can be obtained in most cases. The joint affections of hæmophilia, which are among its most interesting clinical manifestations, have been already described (p. 78).

According to recent views[1] "the essential defect of hæmophilic blood, which accounts for its delayed coagulability, is a diminution of the circulating prothrombin. The other two fibrin factors, antithrombin and fibrinogen, are present in normal amounts."

As to the recognition of the disease "the method suggested by Howell of first oxalating the blood and then recalcifying with an optimum amount of calcium gives a simple and reliable means of diagnosing hæmophilia and of differentiating it from other hæmorrhagic conditions. It is to be recommended that this test be carried out preliminary to any operation on a patient exhibiting the hæmophilic tendency."

Although we have now more means at our disposal for stopping the hæmorrhages than formerly, the *treatment* of the tendency to bleed is most unsatisfactory. The main points are as follows:—

1. In patients who have shown this tendency, no operation should be performed that is not absolutely necessary, and every care must be taken to avoid an injury to the joints.

2. To increase the coagulability of the blood, calcium lactate may be given twice a week in doses of 15 grs. (Wright). The subcutaneous injection of horse-serum has also been found useful.

3. When hæmorrhage occurs and is difficult to arrest, the

[1] S. H. Hurwitz and W. P. Lucas, *Arch. Int. Med.*, 1916, xvii., 543.

handiest method to use is the application to the bleeding point of fresh blood from a healthy individual, along with long continued mechanical pressure. Hurwitz and Lucas have found that, "because of its great hæmostatic properties and its thermostability, kephalin deserves an important place in the treatment of bleeding from external wounds." When applied locally it brings the hæmorrhage to an early arrest, although when given by mouth or in subcutaneous or intramuscular injections "it has no effect on the disease process."

Hæmorrhages in New-born Children.

The occurrence of hæmorrhages from various parts of the body is not uncommon in infants at, or soon after, birth. Cases in which this occurs may be divided into three groups:—

1. **Traumatic cases**, in which the hæmorrhages are obviously started by injuries received during labour. For instance, cephalhæmatoma, hæmatoma of the sterno-mastoid, apoplexia neonatorum, and hæmorrhages into various thoracic and abdominal organs.

In this group the cause usually ceases when the child is born, although the bleeding may go on for some time.

2. **Symptomatic cases**, in which purpura occurs as a symptom of some disease such as congenital obliteration of the bile-ducts, septicæmia, syphilis, or congenital heart disease. In these the inclination to bleed continues indefinitely along with the original malady.

3. **The Hæmorrhagic Disease of New-born Children.**—This disease, of unknown etiology, occurs in apparently healthy infants. The hæmorrhages may take place from the umbilicus, the gastro-intestinal tract, or the vagina, or into the subcutaneous tissue. They may be slight or very severe. The important thing about these hæmorrhages practically, however, is that whatever the cause may be it acts only for a short time, so that energetic treatment is of great importance.

Spontaneous Umbilical Hæmorrhage generally takes the form of a steady diffuse oozing from the site where the cord has separated or is about to do so. It usually starts about the fifth day of life, but may begin earlier or as late as the ninth day. It rarely lasts for more than three days, but is often fatal within twenty-four hours.

Gastro-intestinal Hæmorrhage (*Melæna Neonatorum*).—In these cases the blood is vomited or passed by the bowel, more frequently the latter. Sometimes there is only one large hæmorrhage; more often small quantities of blood are lost repeatedly. The motions passed may be red, but generally they are black in colour. The bleeding generally occurs for the first time on the second day of life, or at least before the fifth; rarely it begins as late as the second week.

It is important to distinguish from this serious disease the "spurious melæna" which consists in the passage of blood which the child has swallowed. This may occur when there are cracks in the mother's nipple or when the child himself has epistaxis. In cases of true melæna the effect of the loss of blood on the child's strength and appearance is soon obvious.

Vaginal Hæmorrhage is generally a trivial matter. It usually begins within the first six days of life, rarely after the twenty-first, and seldom requires any special treatment.

Treatment of Hæmorrhagic Disease.—In any form of serious hæmorrhage in new-born children, the best treatment consists in the injection of human blood or serum from one of the parents.

The ideal method, when all facilities are available, is the direct transfusion of the blood from the parent's radial artery into the child's popliteal or external jugular vein; or, preferably, by Helmholz's method[1] in which the blood is drawn with a needle from a vein in the parent's arm and injected straight, by means of a two-way stopcock syringe, through the anterior fontanelle, into the child's superior longitudinal sinus (see Appendix E). The effect of the transfusion is immediate and very striking, and nearly all the published cases have recovered most satisfactorily. In very severe cases in which the child is entirely collapsed, transfusion should always be performed if possible.

Under the conditions of private practice, however, transfusion may be difficult or impossible to carry out, and it has been found by J. E. Welch,[2] Helmholz, Kerley, and La Fetra,[3]

[1] H. F. Helmholz, *Amer. Journ. Dis. Child.*, 1915, x., 194.

[2] J. E. Welch, *Amer. Journ. Med. Sci.*, 1910, cxxxix., 800.

[3] Helmholz, Kerley, and La Fetra, *Trans. Amer. Pediatr. Soc.*, 1917, xxix., 108.

and many others, that simple injection of the parent's blood under the skin, into the loose tissues of the scapular region or into the muscles of the buttock is generally entirely successful. From ½ to 1 oz. of blood may be injected thrice daily.

There are various other measures which may be taken if transfusion or injections of normal blood cannot be used, or during the interval before they can be carried out.

In umbilical hæmorrhage, intelligent and patient digital pressure on the bleeding point is sometimes successful in stopping the bleeding; and it is well also to apply adrenalin solution locally. Touching with the actual cautery or with nitrate of silver, and the application of plaster of Paris, have succeeded in some cases. If other means fail, the base of the bleeding point should be transfixed by a harelip pin and a ligature applied round it.

In cases of melæna neonatorum the child should be kept as quiet as possible, wrapped in cotton-wool and surrounded by hot water bottles. If very weak, he should not be allowed to suck, but should be fed with a spoon, or syringe and tube, with small quantities of breast milk or peptonised milk cooled on ice. Injections into the bowel are inadmissible, because they do harm by stimulating the intestinal movements. In one or two cases in which the exhaustion from loss of blood was great, I have seen obvious benefit from the subcutaneous injection of 2 or 3 oz. of sterilised salt solution.

The administration of adrenalin by the mouth is often successful in controlling the bleeding. Of this 1 to 2 minims of a 1 in 1000 solution may be given every hour. Out of eight cases of melæna in private practice treated by adrenalin in this way, six made a good recovery.

CHAPTER XXI

ON THE DISEASES OF THE DUCTLESS GLANDS

The Thymus.

THE authorities who have written on the thymus differ greatly as to what is to be considered its normal weight. It is now certain that the older writers gave far too large a figure. This was due to their taking as their standard the thymus glands of infants who had died suddenly during apparently normal health. We now know that it is just in such children that we may expect to find an enlargement of the organ. Thus Friedleben,[1] the greatest of the older authorities, gives 20 grams. as the normal weight; while more recent writers, such as Bovaird,[2] Thursfield,[3] and Dudgeon,[4] place it at 6 or 7 grams. only, and regard anything over 10 grams. as abnormal.

The thymus was supposed to grow in size until the end of the second year; but it is now believed that the organ remains about the same size during this period.[2] The size at any age varies greatly in different individuals, and also in the same individual, according to the state of his nourishment at the time. There is no other organ in the body which changes so much in size.

It is very difficult, if not impossible, to make sure by percussion during life if the thymus is enlarged; and even an X-ray examination often gives inconclusive results.

The functions of the thymus are still very obscure. Many authorities have observed a close mutual relation between

[1] *Die Physiologie der Thymusdrüse in Gesundheit und Krankheit*, Frankfurt a. M., 1858.

[2] *Arch. of Pediat.*, Sept. 1906, 641.

[3] *St Bart. Hosp. Rep.*, 1903, xxxviii., 129.

[4] *Trans. Path. Soc. Lond.*, 1904, lv., ii., 151.

it and the testicles,[1] and on this account, it is probably to be regarded as one of the endocrine organs. Its removal in guinea-pigs leads to an increased size of the testicles, and it is said that in all animals that have been castrated the involution of the thymus is retarded. Many other changes in various parts of the body have been described as following extirpation of the gland, but it is probable that most of these were due to other causes. Park and M'Clure[2] have found that, in the dog, the thymus gland is not essential to life, and that its removal produces no detectible alteration in the hair, teeth, contour of the body, muscular development, strength, activity, or intelligence of experimental animals, and probably has no effect on growth or development, although it may possibly cause retardation in development and delayed union of the epiphyses. They also find that extirpation of the thymus produces no lasting changes in other organs with internal secretions; but it is possible that some well-marked alterations in these may occur during the period immediately following thymectomy.

For such a large and characteristically infantile organ, the thymus has strangely little clinical significance so far as we know. Thymus atrophy is the most characteristic change found in the bodies of atrophied babies—apart from the wasting of their fat and muscles. It is even said that the state of nutrition of an infant may be estimated by a microscopical examination of its thymus.[3]

Status Lymphaticus (*Lymphatism*).

The status lymphaticus is a condition of bodily debility which is chiefly characterised by hyperplasia of the thymus and of the lymphoid tissue generally throughout the body, especially that at the root of the tongue, in the mucous membrane of the bowel, and also to a less obvious degree in the thyroid. This is accompanied by a great lowering of the patient's power of resistance, and is believed to account for a large number of otherwise unexplained cases of sudden death.[4]

[1] Sir Edward A. Schäfer, *The Endocrine Organs*, 1916, 47.

[2] Edwards A. Park and Roy D. M'Clure, *Amer. Journ. Dis. Child.*, Nov. 1919, 479.

[3] Stokes, Ruhräh, and Rohrer, *Amer. Journ. Med. Sci.*, Nov. 1902, 847.

[4] See C. M'Neil, *Edin. Med. Journ.*, Jan. 1914, 25.

Various suggestions have been made as to why such a lymphatic habit of body should give rise to so dangerous a state of weakness of the heart and nervous system, and the question is still undecided. The old view, that the symptoms are due to a sudden congestion of the enlarged thymus causing dangerous pressure on neighbouring vital parts, is now generally abandoned in favour of Paltauf's hypothesis[1] of a morbid diathesis. Escherich[2] believed that a sort of hyperthymisation of the blood takes place, which keeps up a constant state of irritable weakness in the nervous system, so that trivial causes have unexpectedly severe effects. He regarded lymphatism, therefore, as due to a disordered action of the thymus, somewhat in the same way as myxœdema and exophthalmic goitre depend on disordered thyroid action.

Symptoms. — Children with lymphatism are generally, though not always, pale, flabby, and rather fat. If they are infants, they are usually rickety and often have spasmophilia. The tonsils and the adenoid tissue in the naso-pharynx and at the base of the tongue are hypertrophied, and the spleen is palpable. Some enlargement of the lymphatic glands may often be found, and occasionally the hyperplasia of the thymus may be suspected, if not proved, from the amount of dullness on percussion found over and near the manubrium sterni. A lymphocythæmia is also described. Generally, however, the indications of the presence of lymphatism are so vague and indefinite that the child is not thought to be in any danger until serious symptoms set in. Sometimes these consist in a succession of ill-defined convulsive seizures, accompanied by faintness, cyanosis, and dyspnœa, which recur at intervals for weeks or months.

In most cases the fatal syncope occurs as the result of some trivial exertion or shock, without there having been any previous warning of danger. The child who has been regarded as in good health, or, perhaps, as only flabby and unenergetic, suddenly becomes faint, gasping, and cyanosed, his eyes turn up, and he loses consciousness. Convulsive movements may or may not occur. The heart stops before the respiration; and a fatty condition of the myocardium is usually found after death.

[1] *Wien. klin. Wochenschr.*, 1889, ii., 877 ; and 1890, iii., 172.
[2] *Berlin. klin. Wochenschr.*, 1896, xxxiii., 645.

There is often no apparent exciting cause for the seizure, but generally some shock of a trifling kind has preceded it. A sudden plunge into water, a wet pack, a hypodermic injection, even the application of a tongue-depressor, have been known to suffice. Some of the sudden deaths during the administration of chloroform and other anæsthetics, and during convalescence from such infectious diseases as diphtheria and typhoid, are believed to be due to the presence of the status lymphaticus.

Reasons have been recently put forward by M'Neil and M'Gowan[1] for regarding certain types of rapidly fatal epidemic pneumonia, and also malignant forms of scarlet fever and other infectious disease, as being due to the complication of lymphatism with the other diseases.

The **diagnosis** of lymphatism must usually remain more or less a matter of conjecture. When its presence is suspected, the **prognosis** must always be extremely guarded, because any child who possesses a greatly enlarged thymus is likely to have a very slender hold on life; nevertheless, it is probable that many children outgrow the condition.

Treatment.—If the presence of the status lymphaticus is diagnosed or suspected, we must be exceedingly careful about administering an anæsthetic, or even a wet pack, that is not quite necessary, or doing the smallest operation that is not urgently called for. When syncope actually sets in, no known treatment is of any avail.

A number of more or less active forms of treatment have recently been suggested to reduce the thymic hypertrophy. Excision of as much as possible of the organ has been recommended by many, but the operation is not without danger, and the results have been discouraging. Friedlander[2] and Rachford[3] have reported striking improvement from the use of X-rays.

Diseases of the Lymphatic Glands.

It is uncertain whether the lymphatic glands produce a real internal secretion, but it is convenient to consider them here

[1] *Edin. Med. Journ.*, March 1913, 201; and C. M'Neil, *Edin. Med. Journ.*, Jan. 1914, 25.

[2] *Arch. of Ped.*, Oct. 1911, xxviii., 810.

[3] *Amer. Journ. of Med. Sci.*, Oct. 1910, cxl., 550.

along with the other ductless glands. Their peculiar characters in children have already been dealt with (p. 67); and their tuberculous affections are also considered elsewhere (p. 776).

Lymphadenoma.—Lymphadenoma is not a common disease in children. It usually occurs about the time of the second dentition, and its symptoms do not differ from those in later life. In the earlier stages, the general health is but little affected and the chief symptom is great enlargement of the cervical glands, which differ from equally large tuberculous glands in being soft, discrete, movable, and painless. There may also be enlargement of the spleen, which usually has a somewhat irregular surface, and of the liver. Later, the glands in the axilla, groin, and elsewhere also increase in size. In time the enlarged glands become matted, and pressure symptoms occur from involvement of those in the thorax and abdomen. Other symptoms are distension of superficial veins, œdema of the lower limbs, serous effusions, respiratory embarrassment, and jaundice; and general exhaustion with failure of circulation. Hæmorrhages rarely occur, and there is nothing characteristic to be found on examination of the blood. Short periods of pyrexia—continuous, intermittent, or remittent—alternate with periods of normal temperature. The cause of the disease is quite unknown.

The diagnosis may be difficult in the early stages; but, if a superficial gland is excised, its microscopical characters are distinctive. In lymphosarcoma the disease runs a more acute course and jaundice is an earlier symptom. The spleen is usually normal in size, the enlargement of the liver is greater, and there is not the same general glandular involvement. The local condition in the neck is also different, the glands in lymphadenoma remaining soft and discrete for a long time; while those in lymphosarcoma become early matted together and adherent to surrounding parts. The prognosis is altogether bad, probably no real case of the disease recovers. The disease usually lasts for two or three years. Occasionally rapidly fatal cases are met with, and a few live for many years.

Treatment is of little use. Temporary improvement sometimes follows the use of arsenic or X-rays, and salvarsan may be tried.

Lymphosarcoma.—Lymphosarcoma is commoner in children than in adults, though it is not a disease of early infancy.

Although the disease generally begins in the posterior mediastinal glands, its first clinical manifestation is usually a moderate enlargement of the cervical glands; but in a few cases the cervical disease is the primary lesion. For some time after the glands enlarge, the general health remains good. At first the glands are soft, movable, painless, and not adherent to the skin or deeper tissues; but these become involved later. There is no characteristic change in the blood. As the disease progresses, other symptoms develop, such as loss of appetite, anæmia, breathlessness, choking fits, giddiness and faintness, slight cough, and general debility. These go on increasing, diarrhœa and vomiting may occur, the spleen ultimately enlarges, and ascites sets in with œdema of the lower limbs; and the child gradually sinks and dies.

The *diagnosis* is often difficult at first. The glandular swelling differs from that in tuberculous adenitis in showing no signs of periadenitis and being soft throughout, painless, and non-adherent until the later stages. The general health is, at first, less affected and there are usually more signs of mediastinal involvement. In lymphadenoma the glands remain discrete much longer and do not become fused into a lump as in lymphosarcoma; and, in the latter, there is not the same tendency to general enlargement of glands and of the spleen.

When the disease has begun in the mediastinal glands, the condition is hopeless; but, if there is no sign of involvement of the thoracic glands, it is certainly well to have those in the neck excised, in the hope that the case may be one of the rare instances of primary gland affection. In one case (a boy of four years and nine months) reported by D. M. Greig[1] the child was in perfect health eleven and a half years after the operation.

The Thyroid and its Diseases.[2]

During recent years a great deal of work has been done on the physiology and pathology of the thyroid gland, and the very wide-reaching influence that it exerts on the general health of the body at all periods of life has been fully established. The small size of the gland, its isolated position and

[1] *Brit. Journ. of Child. Dis.*, Nov. 1907, 469.

[2] In the following pages the author is much indebted to Dr R. M'Carrison's book on *The Thyroid Gland*, London, 1917.

the unobtrusive nature of its functions have combined to render the clinical investigation of many of its disorders and diseases extraordinarily difficult, so that as yet only a few of the most serious of them can be recognised during life.

In the fœtus and young infant, the thyroid structure is more cellular and shows less colloid than in the adult; its secretion is also scanty and contains little or no iodine. All modern authorities seem to be agreed that the efficiency of the infant's thyroid depends largely on the healthy action of the mother's gland during his intrauterine life. If this is impaired, his thyroid structure is apt to suffer; and it may even undergo a degree of hypertrophy, cellular necrosis, or fibroid change. Hertoghe has maintained that most, if not all, mothers of cretinous children will be found to be suffering from a slight degree of athyria. This is not, however, in accordance with my experience.

During the earlier months of lactation, the mother's thyroid increases its activity in order to supply the wants of the infant through her milk, and to supplement the scanty secretion which his own gland provides. As the calf's thyroid is earlier than the child's in developing fully, cow's milk does not supply the baby with as much thyroid secretion as he should be getting from his mother's milk. In the later months of lactation, and especially after weaning, the infant's thyroid secretion becomes more active, and it remains so during childhood.

The **causes** of abnormal thyroid action (apart from neoplasms) may be either nutritional, toxic, or psychical. It is also said that consanguinity in the parents predisposes to it, and that some children have a hereditary liability to thyroid disease.

Among the *nutritional* causes of thyroid instability are (*a*) a defective or improper food supply (too little food or food which contains too little iodine), (*b*) too much food (especially too much butcher-meat), and (*c*) unsanitary surroundings (bad air and, especially, an impure water-supply).

Bacterial and other toxæmias and infectious maladies of all kinds may have an unfavourable effect on the action of the thyroid, as also have rickets, lymphatism, and other forms of debilitating disease; but it is only rarely that thyroiditis is set up by any of these conditions. Far the most important of all the causes of thyroid disease is the occurrence of toxæmia

arising from the stomach, the bowels, or the teeth.[1] This poisoning may set up hypertrophy of the gland followed by atrophy, or primary atrophy may occur without previous enlargement.

Like the adrenals the thyroid is capable of being incited to excessive action by *psychical influences*, such as fear and other strong emotions.

Thyroiditis.—Acute inflammation of the thyroid, which can be clinically diagnosed as such, is a very rare disease; but acute and chronic forms of thyroiditis which cause no symptoms, are probably not uncommon. They occur as complications of acute infectious diseases, or of intestinal and other toxæmias, and are generally only recognised afterwards, by the resulting thyroid deficiency. The chance of the thyroid recovering its function depends largely on the state of the child's general nutrition at the time of his convalescence.

Acute thyroiditis is not uncommonly simulated by septic inflammation of the lymphatic glands which lie close to the thyroid. When the organ itself is inflamed, the resulting swelling is painful, and moves with swallowing; and the child holds the head forward with the neck stretched out. There is also a degree of dysphagia and dyspnœa with a peculiar stridor. An abcess generally forms.

Chronic Enlargement of the Thyroid.—A slight degree of thyroid swelling is very common in girls about the time of puberty. It is often associated with delayed or irregular menstruation, with chronic intestinal disturbance, and functional nervous symptoms. Under these circumstances, it has usually no serious significance.

Simple goitre occurs now and then sporadically in this country, usually in older children, and apart from any symptoms of cretinism. In most of these cases no cause can be discovered; but, in a few, the disease has begun during or after residence in Switzerland or in one of the few remaining goitrous areas in England. The disease is very chronic, and generally causes little inconvenience. Many of the cases recover in time with or without treatment.

The most important part of the treatment consists in

[1] Osborne, *New York Med. Journ.*, 2nd March 1918, cvii., No. 9, 385.

very careful attention to the state of the bowels. In endemic cases, M'Carrison has found great benefit from the use of thymol, which he gives to adults as a coarse powder in doses of 10 grs. washed down with drinks of water. While it is being taken, the bowels must be kept moving and no solvent of the drug given in the food. Salol and β naphthol may also be used; though less efficacious, they have the advantage that they require no restriction of the diet. Soured milk may also be tried, and an autogenous vaccine of the bacillus coli group is sometimes beneficial. Residence at the seaside is advantageous. The diet should consist largely of vegetables, and causes of emotional disturbance must be avoided.

The medicinal treatment consists in the administration, thrice daily, of small doses of iodide of potash (3 to 5 grs.), tincture of iodine (3 to 5 minims), or thyroid (2 to 5 grs.), along with bicarbonate of soda (5 to 10 grs.). Biniodide of mercury ointment may be used for local inunction. X-ray treatment has proved beneficial in some cases.

Gummata and tuberculous nodules are occasionally found, post-mortem, in the thyroid, but they are not of clinical importance.

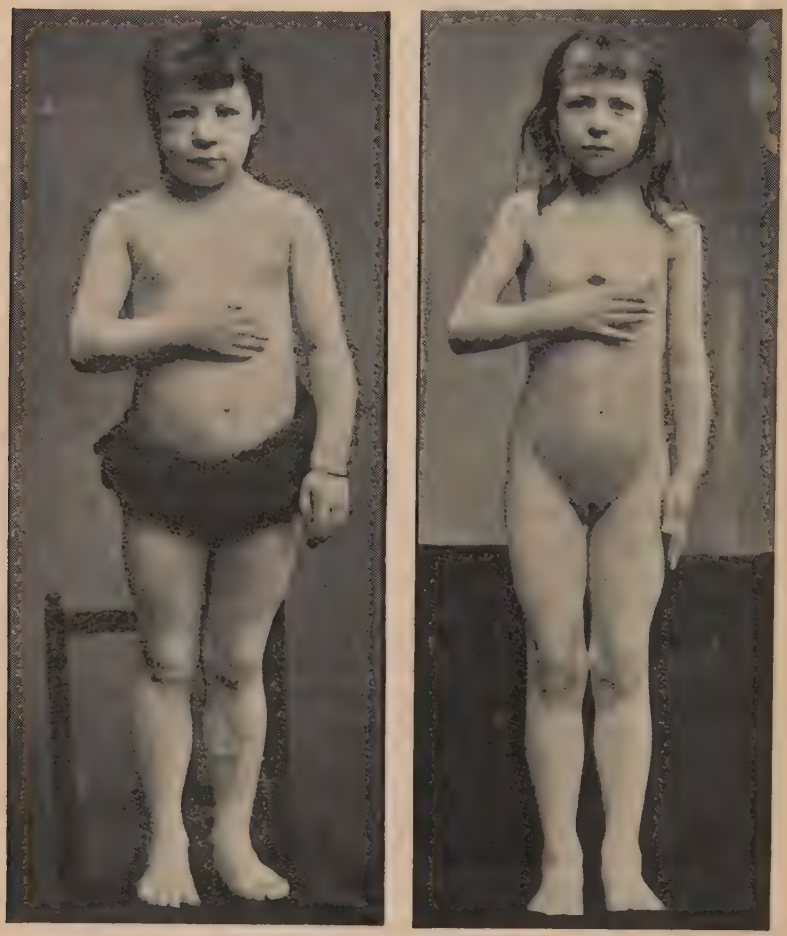
Graves' Disease.—Exophthalmic goitre is very rare indeed in early childhood, and is uncommon in a typical form in older children. The worst case I have seen was in a boy of ten, in whom the symptoms set in immediately after a Zeppelin raid. Sometimes in cases of chorea, we find mild symptoms of Graves' disease — thyroid enlargement, slight exophthalmos, von Graefe's sign, and a quick pulse.

The prognosis of Graves' disease in children is usually good. All the cases I have seen have been in hospital practice; and the rest and quiet in the ward, with careful dieting, have always led to improvement in the general health, and to steady recovery from the special symptoms.

Myxœdema.

It is often impossible to distinguish myxœdema, which originates in infancy, from congenital cretinism; and, practically, it is not important to do so. In rare instances, however, we meet with typical cases of the disease beginning

in older children which do not differ in symptoms or treatment from those in adults (Figs. 111 and 112).



FIGS. 111 and 112.—Juvenile Myxœdema, before and after thyroid treatment. Girl of 12 years.

Endemic cretinism has almost, if not entirely, ceased to occur in Great Britain and need not be discussed here.

Sporadic Cretinism.

Causation.—The primary cause of the destruction of the thyroid which produces cretinism is still entirely unknown.

The disease generally appears in quite healthy families, though occasionally more than one case is found in the family; and such conditions as achondroplasia, infantilism, and other kinds of dwarfing have, not very rarely, been described among the other children. There seems to be no reason to connect the occurrence of the sporadic form of the disease with the physical characters of the district in which it is found.

Presumably the disease may be due to a poison, produced in the mother's intestine during pregnancy, acting on the thyroid of the fœtus; but, after most careful enquiries into the health of the mother during pregnancy in a large number of cases, I have never been able to find any evidence of special ill-health on her part to which the condition of the fœtus could be ascribed. In four cases the mothers subsequently developed a small goitre, but in none of them did recognisable symptoms of myxœdema occur.

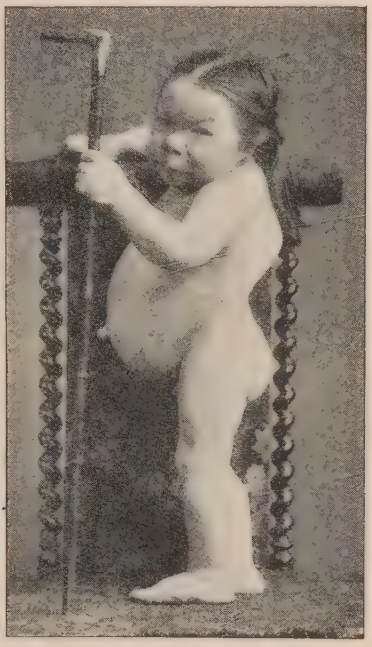


FIG. 113.—Sporadic Cretinism, untreated. Girl of 22 years.

Symptoms.—The characteristic appearances of cretinism as it is seen in adults and older children are readily recognised. The extremely stunted growth, large head, relatively short, thick-set limbs, thick dry redundant skin, with supraclavicular swellings, bloated features, and often protruding tongue, and the other well-known symptoms, form a clinical picture which is not easily forgotten or mistaken for anything else (Fig. 113).

Usually, however, no typical symptoms (with the occasional exception of a protrusion of the tongue) are present at birth, so that the condition is much less easily diagnosed in young children than in older patients. Cases of greatly deformed new-born cretin babies, with large supraclavicular swellings

and other characteristic appearances have, indeed, been described, but these rarely, if ever, occur in this country. As a rule, even in cases which afterwards present the severest type of the disease, the child's relatives see little amiss with him until he is several months old. All that the mother usually notices at first is that the child is too quiet and dull, that he does not cry out like other children, that his voice has a peculiar harsh tonelessness, and that he scarcely ever laughs. His limbs also are stiff in their movements and their extremities chilly; and he tends to be extremely constipated. The protrusion of the tongue is often remarked on, though no other physical abnormality is observed. In some cases there is, from the first, a disinclination to be fed either by the breast, bottle, or spoon. The teeth may appear at the usual time or they may be late. In sixteen cases in which this point was noted, the first incisors were cut between the fourth and eighth month in four; between the eighth and twelfth month in four; during the twelfth month in four; and between the fifteenth and twenty-second month, also in four cases. The patient may begin walking as early as fifteen months, but more frequently not till he is two, three, or four years old, or even later.

The tardy development of the characteristic signs of the disease makes it especially important that we should be on the outlook to mark its earliest indications, for there is good reason to believe that the ultimate degree of improvement in these children varies directly with the earliness of the age at which the treatment is begun.

Although the mother may fail to see anything wrong with the child at first, careful clinical observation will generally reveal quite enough physical change to establish a diagnosis of the cause of the dullness even in early infancy (Figs. 114, 115, 118, and 119). The face is usually pale and distinctly puffy, the forehead somewhat wrinkled when the eyes are open, the hair dry and scanty, and the fontanelle very large. The child generally snores at night. There may be some fullness in the supraclavicular region, although distinct tumours rarely form there in infancy; and the ease with which the tracheal rings can be felt will indicate an absence or defect of the thyroid. The hands are often broad, thick, and short, and their skin is wrinkled and seemingly redundant. This will

sometimes be as helpful in the diagnosis as any other single feature. The temperature is subnormal.

As the child grows older, his development lags behind and the characteristic cretinous appearance becomes steadily more striking. The myxœdematous swelling increases in the face and elsewhere, the belly becomes more prominent, and marked lordosis develops. There is generally an umbilical hernia. Circumscribed soft swellings appear above the clavicles and in

FIG. 114.—Sporadic Cretinism. Boy of 7½ months.

FIG. 115.—Sporadic Cretinism. Girl of 15 months.

front of the axillæ. The dryness of the skin increases, and in later childhood the hair becomes scanty and dry. The fontanelle remains widely open. The milk-teeth generally remain far too long in the gum, and I have seen them all present as late as the nineteenth year.[1] The child's growth and activity are greatly interfered with, so that at ten or twelve years old he often has not the size or strength of a boy of three or four. The mental condition in an ordinarily severe case is that of imbecility, but in slighter forms of the disease the child seems merely backward. He is dull and apathetic, slow of movement and of apprehension, but neat and tidy in his ways,

[1] *Edin. Med. Journ.*, May 1893, xxxix., 720.

and quiet and docile unless he is teased. Speech is generally long of being acquired, and the words used are few. Considering the well-known prevalence of deaf-mutism in cretinous districts, it may be of interest to mention that I have only seen one case of deaf-mutism in a sporadic cretin—a little girl of considerable intelligence.

The cretin's nervous system reacts very imperfectly to acute disease; and such severe illnesses as purulent meningitis or acute pneumonia may give rise to curiously slight symptoms, and are therefore apt to be overlooked.

I have seen one or two instances of sporadic cretins who presented symptoms similar to those described by M'Carrison as *Nervous Cretinism*, in the endemic form of the disease. In these, the parathyroids are probably affected as well as the thyroid. In addition to the ordinary indications of athyria, there was so much stiffness of the limbs that at first a birth-injury to the brain was suspected (Fig. 116). Prolonged thyroid treatment, however, caused in time, complete disappearance of the spasticity. The mental condition of these patients was that of a low grade imbecile.

Diagnosis.—Slight cases of cretinism are sometimes met with (Fig. 117) in which there is little beyond stunted growth, delayed closure of the fontanelle, and some degree of mental dullness. Confirmation of the diagnosis is to be sought in the remarkable improvement which follows thyroid treatment.

The two morbid conditions most apt to be mistaken for cretinism are mongolism and achondroplasia. In mongolism the likeness is not very great even in older children. In infancy the mongol and the cretin have really little in common beyond the mental backwardness, the frequently protruded tongue, and the general fact that they are rather ugly babies. The mongol differs from the cretin in having a softer skin, rather small-boned limbs, a comparatively thin neck with a palpable thyroid, a normal temperature, the peculiarity of the hands elsewhere described (p. 678), and generally a lively disposition.

The resemblance which achondroplasic dwarfs have, at birth, to cretins is in some ways striking, but it is *adult* cretins that they resemble. The differential diagnosis is considered elsewhere.

When a cretin has been treated for a short time, even

intermittently, with thyroid, the diagnosis often becomes very difficult, if not impossible.

Treatment.—This consists in the continued administration of some preparation of thyroid by the mouth. The fresh raw gland is probably more active and trustworthy than any of its preparations; but nowadays it is rarely used. It may be

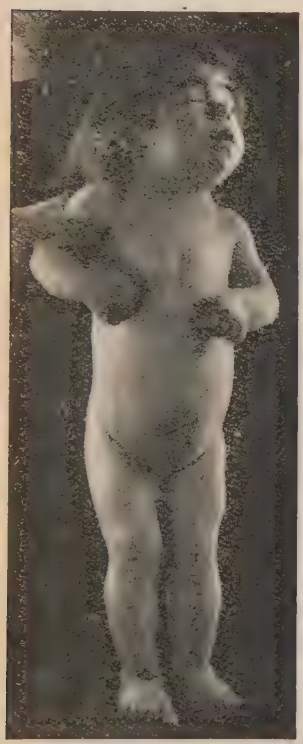


FIG. 116.—Sporadic Cretinism. Nervous type. Girl of 7 years.

FIG. 117.—Sporadic Cretinism Slight case. Girl of 5 years.

given to a young child in doses of $\frac{1}{16}$ to $\frac{1}{8}$ of a lobe *twice a week* to begin with, and may be increased according to its effect. It is a curious fact that the improvement in cases where thyroid is given twice a week seems usually just as continuous and satisfactory as that seen when the remedy is administered in small doses daily or every few hours.

Generally, however, it is much more convenient to use one of the manufactured preparations and to give it once daily.

THYROID TREATMENT OF CRETINISM.

FIG. 118.—Sporadic Cretinism. Girl of 17 months. Before treatment.

FIG. 120.—Sporadic Cretinism. Same patient after 1 month's treatment.

FIG. 122.—Sporadic Cretinism. Same patient after 3 months' treatment.

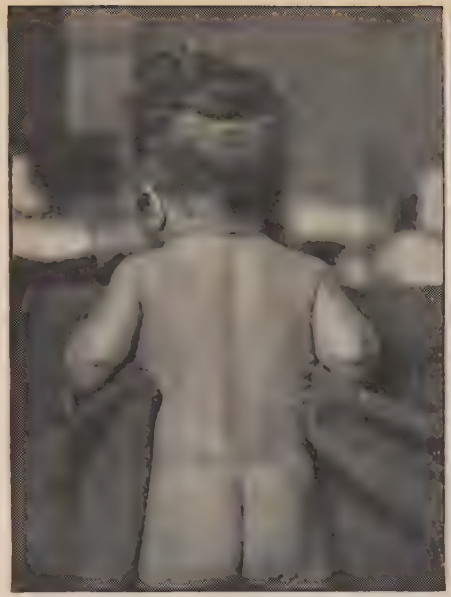


FIG. 119.—Sporadic Cretinism. Back view of same.

FIG. 121.—Sporadic Cretinism. Same patient after 3 months' treatment. Back view.

FIG. 123.—Sporadic Cretinism. Same patient after 12 months' treatment.

The tabloids prepared by Messrs Burroughs & Wellcome are probably the form most widely used, and they do well, provided they have been kept dry. A tabloid of 1 to 2½ grs. of gland substance may be given to a young infant every third day to begin with. If no unpleasant symptoms arise, the dose may be given every second, and then every day. In older children twice these doses or more may be used. The effect of the first few doses should be carefully watched.

The right dose of thyroid differs considerably in different cases and must be determined in each by watching the effect of the remedy on the child's appearance, vigour, weight, growth, and temperature. If he is gaining satisfactorily in height and is fairly active, and if his general condition is good, the dose is probably sufficient. If he is not growing as he should in height, is gaining weight steadily, and is remaining torpid and disinclined for exertion, it will be well to increase the amount of thyroid given.

During treatment, except in severe or debilitated cases, the child may go about as usual, and no special diet is required. Should he become feverish and develop sickness, headache, and malaise, this shows that much too large a dose has been given. He should under these circumstances be kept in bed and the thyroid stopped for some days.

When thyroid treatment is begun for the first time in older children or adolescents, it is important to keep the patient off his feet for a large part of the day. At these ages the thyroid has a tendency to cause softening of the shafts of the long bones, and unless great care is taken to prevent it, severe bowing of the legs will develop.[1] This danger does not seem to exist in children under the age of puberty.

Result of Treatment.—When the thyroid is carefully given, rapid and continuous improvement almost always ensues (see Figs. 118 to 127). Cases are, however, occasionally met with in which, for unknown reasons, the improvement is not nearly so satisfactory as usual. In a few instances the administration of thyroid sets up severe diarrhœa or causes heart failure, and has therefore, for a time at least, to be abandoned.

Generally the result of the treatment is most strikingly satisfactory. The temperature rises to, and remains at, the

[1] "Variations in and Limits of Improvement of Cretins of Different Ages under Thyroid Treatment," *Brit. Med. Journ.*, 12th Sept. 1896, 618.

FIG. 124.—Before treatment. Age $4\frac{11}{12}$ years. Height 32 in.

FIG. 125.—After 7 months' treatment. Height $34\frac{1}{4}$ in.

FIG. 126.—After 12 months' treatment. Height $37\frac{3}{4}$ in.

normal level. The unnatural swelling quickly disappears from the face and other parts of the body. The features lose their unnatural thickness and become more mobile and expressive, and the eyes brighten. At the same time the tongue ceases to be protruded, the voice becomes less guttural, and the child no longer snores at night. The abdomen diminishes rapidly in circumference; and, if a small umbilical hernia has been present, it disappears. The supraclavicular swellings vanish at an early stage of the treatment. The skin loses its harsh and dry feeling and becomes soft, and the cheeks show a natural flush. In young patients, the hair sometimes falls out, at first, in considerable quantities; but it is soon replaced by a new crop, which grows more rapidly and is softer and often of a different shade of colour. The joints are no longer kept slightly flexed, the limbs become firm and strong, and the back also grows straighter and more shapely. The retarded evolution of the teeth is actively resumed.[1] The appetite is generally much increased by the treatment, and the bowels usually become regular in action.

The growth of the skeleton is perhaps the most striking change of all. It begins at once and proceeds rapidly. The child often gains as much as 2 in. in height within the first two months, and may make as much as 6 or 8 in. in the first year. After that, the rate of growth diminishes and approximates to the normal. In cases where the treatment is begun in early childhood, the return of normal growth affects all the limbs equally. If the patient is an adolescent, however, when the thyroid is first given, the upper limbs grow freely while the lower remain very much stunted.[2] Although the muscular tone of the limbs improves greatly, their finer movements (*e.g.*, those of the hands) are apt to remain clumsy compared to those of a normal child.

In a large proportion of the cretins who are treated from infancy with thyroid, troublesome enuresis occurs. It seems indeed impossible in some cases to give enough thyroid to influence the growth satisfactorily without occasioning this symptom. Belladonna and other drugs have usually, so far

[1] If thyroid is given regularly to a cretin from infancy onwards, the permanent teeth generally appear about a year earlier than usual.

[2] "Variations in and Limits of Improvement of Cretins at Different Ages under Thyroid Treatment," *Brit. Med. Journ.*, 12th Sept. 1896, 618.

as my experience goes, very little effect in checking this form of incontinence, but it always recovers in time.

The mental improvement which occurs from thyroid treatment is apt at first to be overestimated by the parents, because the child *looks* so much brighter and his movements are so much livelier than before. Within six months, however, there is unmistakable advance, and this continues and increases, the better nourished brain becoming increasingly capable of good work. The children grow more inquisitive, more independent and enterprising, and are more inclined to do things. They lose their shy, morose, self-centred disposition, and become happy, playful, childlike, and sociable.

FIG. 127.—Sporadic Cretinism. Same patient as in Fig. 124, 32 years old, with her normal child.

In the milder cases, the arrears of bodily growth are soon fully made up, the child comes to look normal, and the state of his intellect nearly approaches, and sometimes *quite* reaches, the normal. There is, however, a considerable proportion of cases in which the bodily recovery is more or less complete, but still the child remains an imbecile; and, under these circumstances, the power of speech is often almost or quite in abeyance. In those cases in which the treatment is not begun until later childhood, the disposition improves and the *capacity for happiness greatly increases*, but the intellectual condition always remains very defective.

The prognosis as to bodily and mental capacity in after-life varies greatly in different cases. Many of the slighter cases are able, on leaving school, to earn a few shillings a week at various easy occupations. One patient whom I have observed for many years, and who has been continu-

ously treated, is now the capable mother of a quite healthy child (Figs. 124 to 127).

The Parathyroids.

It has been found that thyroidectomy in man is always followed by tetany, unless one at least of the parathyroids is left; and that in many animals, though not in all, complete removal of the parathyroids alone always causes it. When tetany is produced in this way, it is also found that it can only be cured by a successful graft of the parathyroid from an animal of the same species (Schäfer[1]).

Escherich[2] and many other authorities have held that disease of the parathyroid is the cause of the tetanoid condition; but, although there are many pathological and experimental facts which support this theory, there are still difficulties that require to be cleared up before it can be regarded as proved. The subject will be dealt with in the chapter on Spasmophilia (p. 436).

Diseases of the Pituitary Gland.

Hyperpituitarism.—In rare cases, acromegaly begins in later childhood. In one instance,[3] for example, a male acromegalic showed symptoms at puberty; and his daughter, at fourteen, was already a well-marked case of the disease. A patient of Fraentzel's[4] had typical symptoms at eleven; her father also suffered from acromegaly.

Hypopituitarism.—Deficient pituitary secretion is believed to be the cause of *Fröhlich's Syndrome* or *Dystrophia Adiposo-genitalis*.[5] This condition is usually seen in older children. Its chief manifestations are obesity, affecting the trunk mainly, peculiar fat hands with conical fingers (Fig. 128), deficient stature and an infantile condition of the genital organs. There is also usually headache, with bilateral hemianopsia and other signs of a tumour in the region of the hypophysis. In some of the cases we find a greatly increased tolerance for glucose.

[1] *The Endocrine Organs*, London, 1916, 23.
[2] *Die Tetanie der Kinder*, Wien u. Leipzig, 1914, 177.
[3] Franchini and Giglioli, *Nouv. icon. de la Salpêt.*, 1908, xxi., 325.
[4] Virchow, *Illust. Med. News*, 16th March 1889, ii., 241.
[5] Fröhlich, *Wien. klin. Rundschau*, 1901, xv., 883.

The symptoms may be produced by a tumour of the pituitary, but similar manifestations have sometimes been observed in cases where the gland was found normal on microscopical examination. No striking improvement under treatment with pituitary substance has been recorded in these cases. An X-ray examination of the cranium often, though not always, shows enlargement of the sella turcica.

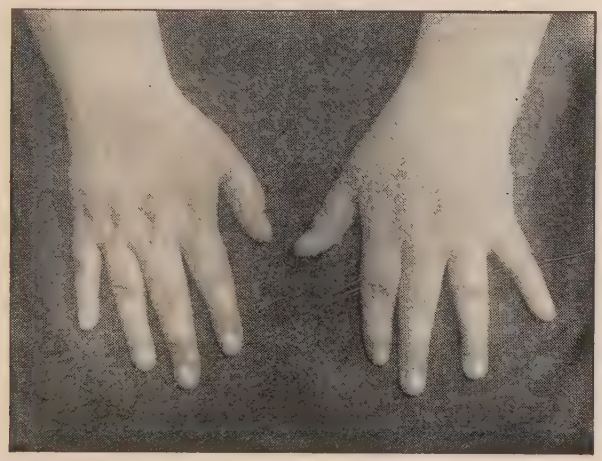


FIG. 128.—Hands in Hypopituitarism.

Disease of the Pineal Gland.

Tumours, especially teratomata, are found in the pineal gland in rare cases in childhood. The main symptoms are obesity, remarkable growth of hair in the pubic and other regions, with precocious development of the genital organs, mental precocity or mental defect, and sometimes extreme sleepiness. The symptoms usually develop in early childhood—before nine years old. The condition is distinguished from pituitary disease, by the state of the genital organs and by the character of the cerebral symptoms. Its cerebral symptoms also distinguish it from cortical hypernephroma.

Diseases of the Suprarenal Glands.

Addison's Disease is very rare in early life, but it occasionally occurs as a symptom of generalised tuberculosis

in older children. Absence or defective development of the suprarenals is found in most cases of anencephaly.

The medulla and cortex of the suprarenals are really distinct organs; and, when the gland becomes diseased, the symptoms differ entirely according as one or other of them is involved.

Malignant Medullary Hypernephroma.[1]—It is characteristic of the clinical course of carcinomata or sarcomata of the suprarenal medulla that the earliest signs of their presence are generally connected with the spread of secondary metastatic deposits in the area of the lymphatic system of the side affected, and do not consist in suprarenal signs or symptoms. At first, the child is vaguely ill and may complain of pains in the lower limbs and have a mitral systolic murmur. A very important early sign is the occurrence of hæmorrhages in the region of the orbit of the affected side, like those seen in infantile scurvy. This is apt to be followed by proptosis from a tumour growing in the wall of the orbit, and tumours may also form on the temporal and other cranial bones, and on the ribs, liver, lungs, and thoracic duct. The brain itself is not involved, but increased cranial tension causing headache and optic neuritis is usual. The temperature may or may not be raised, the leucocyte count and the blood-pressure are normal.

The patients are mostly under four years old, and the disease, which is always fatal, may last from twelve days to eighteen months (Frew).

Cortical Hypernephroma.—Tumours in the suprarenal cortex may be carcinomata, sarcomata, or rarely non-malignant adenomata. They may produce two varieties of symptoms. In one of these—the *Infant Hercules Type* (Parkes Weber)—which has only been found, as yet, in boys, there is excessive growth of the body, great muscular development, hirsuties, and precocious development in size and function of the sexual organs, with no great obesity. In the other, which usually develops about the second year of life, in either girls or boys, the chief symptom is obesity, sometimes with hirsuties, but with no premature development of the sexual functions. The distribution of the fat resembles that seen in adults, being

[1] R. Hutchison, *Quart. Journ. Med.*, 1907-8, i., 33; and R. S. Frew, *ibid.*, 1911, iv., 123.

most on the cheeks, neck, and body, and less on the limbs. Although these are the characteristic symptoms of tumour of the suprarenal cortex, in some cases in which they were present, nothing abnormal has been found in these glands.

Hæmorrhage into the Suprarenals.—Bleeding into one or both of the suprarenals is frequently found in new-born children as a result of birth injury. It sometimes occurs in children of a few days old from septicæmia; but the most interesting type of the disease is that which occasionally sets in in children during the first year of life as part of a rapidly fatal illness. The disease sometimes occurs as an epidemic, though there is no other reason to believe it to be infectious. The symptoms set in suddenly with severe abdominal pain, high fever, and sometimes vomiting and diarrhœa. Scattered purpuric spots may appear over the surface of the body. Convulsions are common, and death occurs usually within twenty-four hours, with quick pulse and respiration, and general collapse. No treatment has any effect.

CHAPTER XXII

ON SPASMOPHILIA

SPASMOPHILIA is the name now usually given to a chronic disturbance of the health in early childhood, which is very common in this country, and deserves to be more generally recognised as a definite clinical entity. It may be described as a peculiar abnormality of the constitution which is characterised by habitual irritability of the whole peripheral nervous system to electrical and mechanical stimulation (as shown by the presence of Erb's, Chvostek's, and Trousseau's symptoms), and also to that set up by chemical changes in the body. It further manifests itself, in many cases, by the occurrence, from time to time, of such striking and characteristic clinical phenomena as tetany, laryngismus, and general convulsions.

As tetany is the symptom which has aroused most interest, spasmophilia has often been called a *tetanoid condition*—the term *manifest tetany* being given to the cases in which that symptom is present, while those in which it has not occurred are described as *latent tetany*. As Cheadle pointed out long ago,[1] the tetany, laryngismus, and convulsions which occur in these cases are not to be regarded as separate diseases or complications, but merely as more or less acute passing manifestations of the general state of chronic nervous erethism which is now called spasmophilia. Slight intercurrent disorders such as digestive disturbances, painful dentition, and infectious catarrhs are among the commoner causes which bring on these severer manifestations. The specially characteristic manifestations of the tetanoid state may first be considered.

Erb's Symptom, which consists in an abnormal excitability of the peripheral nerves to electrical stimulation, is generally the earliest indication of spasmophilia to develop; and it is also that which is most constantly present. It can be best

[1] "Pathology and Treatment of Laryngismus, Tetany, and Convulsions," *Lancet*, 1887, i., 919.

demonstrated in the case of galvanism; and it is characterised by certain peculiar alterations in the kind, as well as in the extent, of the electrical response. The main peculiarities are that the anodal opening contraction is produced by a less current than the anodal closing contraction, instead of requiring far more, as it does in normal children; and that a kathodal opening contraction is caused by a current of less than five milliampères.

To apply the test, the peroneal nerve-muscle group may be used, the negative electrode being placed over the upper abdomen and the positive over the peroneal nerve as it winds over the head of the fibula; or the median nerve may be

FIG. 129.—Facial Irritability. Before tapping.

FIG. 130.—Facial Irritability. On tapping.

preferred. The skin resistance varies directly in individual instances according to the amount of subcutaneous fat present, and diminishes rapidly as the operation proceeds.

Chvostek's Symptom (Mechanical Irritability of the Motor Nerves) is a much commoner and more important phenomenon in early childhood than in later life. It is most frequently seen and most easily studied as it affects the facial nerve—*facial irritability*; but in many cases it can be elicited by tapping over any of the motor points in the body.

Facial irritability consists in a momentary contraction of the muscles supplied by the facial nerve, when a sharp tap is given by the finger to the cheek below the malar eminence. The contraction resembles that caused by the passing of a galvanic current (Figs. 129 and 130). It is sometimes more active on

one side of the face than on the other, and in some cases more noticeable in the upper, in others in the lower, half of the face. Sometimes only the lips are moved.

Chvostek's sign differs essentially from the infantile lip-reflex (p. 554) in the following respects. It is observed equally during sleeping and waking, in children of any age, and it is not a reflex, but due to direct mechanical stimulation of the nerve. The movements elicited are confined to the side tapped, they are momentary, and are not at all co-ordinated or purposive. When found in children under two years, its occurrence probably always indicates the presence of spasmophilia. It is rarely met with in infants under five months old.

The lip-reflex, on the other hand, occurs almost exclusively during sleep, is most active in very young babies, and has the characters of a true reflex. Its movements involve both sides of the mouth, and they are deliberate, co-ordinated, and quasi-purposive. In its ordinary form, the lip-reflex is a normal phenomenon.

Facial irritability is not uncommon in older children, and occurs in them, not only in tetany and in progressive dementia, but also with slight dyspeptic disorders, and frequently apart from any ascertainable disease. In young children it is the most useful diagnostic sign of spasmophilia.

Trousseau's Symptom.—This is the name given to the appearance or recurrence of the characteristic tetany posture of the child's hands or feet, during a free interval, when the main artery or nerve of the limb is compressed. In many cases this symptom cannot be obtained in young children; but in some it is very well marked. It is most easily elicited by tying a piece of rubber tubing round the upper arm. This symptom is oftener absent in infantile tetany than in the adult form of the disease.

Tetany is chiefly characterised by the peculiar attitude which the limbs assume. The elbows, and often the wrists also, are flexed; and the hands, owing to spasm of the interossei, assume the so-called "accoucheur's position" (Figs. 131, 132, and 133). In this the fingers are somewhat flexed at the metacarpo-phalangeal, and fully extended at the interphalangeal joints. They often overlap one another, and the thumb crosses the palm so that its tip touches the middle phalanx of the ring finger. In young babies the position of the hand is often

FIG. 131.—Girl of 13 months.

FIG. 132.—Girl of 9 months.

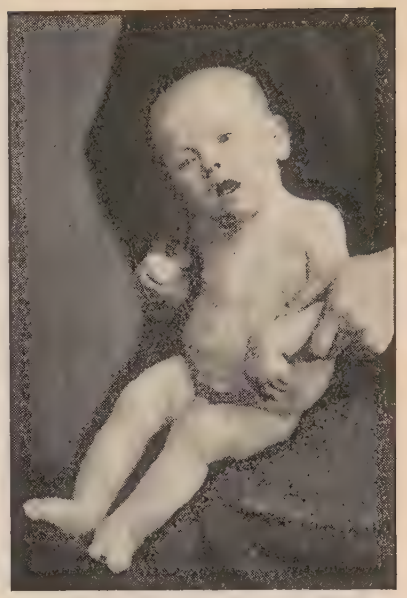


FIG. 133.—Boy of 7 months.

different, the fingers being merely flexed to an extreme degree into the palm, with the thumb either doubled under them or projecting between two of the proximal phalanges. Various transitional postures are met with such as that seen in Fig. 133.

The lower limbs are usually affected along with, and sometimes without, the upper. The front part of the sole is contracted so as to produce an antero-posterior furrow, and there is also extreme plantar flexion of the toes. In some cases, the muscles of the back and neck are implicated, causing rigidity of the neck and slight head-retraction.

The muscular contractions vary in severity, from time to time; and, in severe cases, regular recurrent spasms occur. During these, there is often redness, tenderness, and swelling of the back of the hands or of the insteps, with a considerable amount of pain, so that the condition may be mistaken for rheumatism. In most of the ordinary mild cases of infantile tetany, there is no pain at all. The contractions of the limbs always affect both sides of the body at once; but sometimes one side is rather more severely affected than the other. They generally pass off in a few hours or days; but in severe cases, they may last for weeks, or even for months, and relapses are very common. Slight cases of infantile tetany used to be spoken of as "carpo-pedal spasms."

In some severe cases the facies is characteristic; the forehead is furrowed, the eyes stare, and the lips are protruded, so that the mouth has been likened to that of a carp.

Other Types of Tetany in Children.—In addition to the common infantile type of tetany, other much rarer types have been described. Two of these may be referred to here.

In bad cases of *gastro-intestinal disease* in infants, a very severe toxic type of tetany is occasionally met with as a late complication. Its appearance is of grave significance, as it indicates a very serious degree of toxæmia. It is often not accompanied by laryngismus or convulsions.

The tetany which occurs *in older children* is generally slight in degree, and its etiology is obscure. Occasionally we discover some cause of intestinal disturbance, such as intestinal worms, or a chronic disease of the bowel, which seems to account for it. When it occurs as an *epidemic*, as it sometimes does in resident institutions for children, it is probably due to something wrong with the diet.

The diagnosis of tetany in older children is generally easy, but occasionally its symptoms are simulated by hysteria. In hysterical cases, however, only one side of the body is generally affected. The symptoms of ergotism are said sometimes to resemble those of tetany very closely.

Laryngismus (*Spasmus Glottidis*, *Child-Crowing*).—This is a spasmodic nervous affection of the respiration which, in its typical form, causes a sudden arrest of breathing for a few seconds, or longer, with the chest in the position of expiration, and is followed by a crowing inspiration. While this is what generally happens, the arrest of breathing may occur with the chest in the position of inspiration, and then no crowing follows. The most striking phenomenon in an ordinary attack is the spasmodic closure of the glottis, but the other muscles of respiration also participate in the spasm. Laryngismus, therefore, is to be regarded as an affection of the respiratory centre, and not merely a local spasm of the glottis.

The symptom, in its typical form, probably only occurs in children who are the subjects of spasmophilia, and the patient has usually been out of sorts for some days or weeks before it sets in; but the attacks generally occur with great suddenness. The patient, who has been sleeping quietly or playing about as usual, all at once stops breathing, looks scared, and throws back his head with his mouth open. In severe cases, the body and limbs are rigid and the fists clenched. The face is at first cyanotic, and afterwards turns ashy pale. There may be a short loss of consciousness, and occasionally the attack ends in a general convulsion. After a few seconds, the spasm relaxes and there is a loud crowing inspiration somewhat like the "crow" of whooping-cough. In many of the slight cases, a few laboured inspirations, accompanied by crowing, are all that can be observed. In the severe type, the arrest of breathing may be so complete and prolonged that the child dies in the attack. The number of the paroxysms, as well as their severity, vary greatly in different cases. In some there are only a few seizures in the twenty-four hours, in others there may be twenty, thirty, or more. They generally occur more frequently during the night.

Although the children practically always show marked signs of progressive rickets, they are often rosy-cheeked and fairly well nourished. Most of them, however, have other

symptoms of spasmophilia. Thus, in a hundred consecutive cases, sixty-nine showed facial irritability, twelve had tetany, and no fewer than sixty were said to have had general convulsions. A history of convulsions was much commoner in the boys than in the girls.

Laryngismus is also more frequent in boys, and it often occurs in several members of a family. As Gee and others have pointed out, it is most commonly met with in this country in the first half of the year. In the hundred consecutive cases above referred to, eighty-one occurred between January and June, and only nineteen between July and December.

The *immediate cause* of the seizure is generally some emotional disturbance or slight nervous shock. A paroxysm often occurs on awaking from sleep, when the child is suddenly exposed to a draught of cold air, or when he is frightened or annoyed in any way—also during swallowing and straining. The tendency of emotional shocks to bring on a severe paroxysm is a most important matter in practice. One result of it is, that children with laryngismus are among the very few cases that are generally better treated at home, even in the poorest surroundings, than in a hospital ward. In them the comfort and assurance afforded by the mother's arms count for more than the most skilful nursing.

The diagnosis of laryngismus usually presents no difficulty. The condition which most closely resembles it is the **nervous arrest of breathing** which is sometimes met with in young children who are neurotic and spoiled. Probably, as H. Neumann[1] and Ibrahim[2] have suggested, these attacks are to be regarded as manifestations of infantile hysteria. The seizure is brought on by a fit of temper or by a sudden injury or fright; and the child, who is generally between two and five years old, finds on trying to scream that he cannot do so. He turns pale, his body stiffens, and he seems to lose consciousness. After a few seconds, or at most a minute or two, the respiratory spasm relaxes; and, without any crowing inspiration, he begins again to breathe and cry normally. These attacks differ from those of laryngismus in their lesser severity, in the patients

[1] "Ueber das Wegbleiben kleiner Kinder," *Arch. f. Kinderheilk.*, 1905, xlii., 99.

[2] "Ueber respiratorische Affectkrämpfe im frühen Kindesalter," *Zeitschr. f. d. ges. Neurologie u. Psychiatrie*, 1911, v., 3, 388.

being usually older children, and in their not having had convulsions or tetany and not showing facial irritability or any of the other signs of spasmophilia. The condition is generally a trivial one, but in a patient who was the subject of lymphatism the attack might prove fatal. The treatment is that of the hysterical state, and the mother must be told not to be anxious. As Leonard Guthrie says, "the temperate use of a slipper" is often an excellent remedy.

False croup should never be mistaken for laryngismus. The patients in the latter are younger, the spasms are shorter in duration; cough, fever, and coryza are absent. In any doubtful case, a history of convulsions and the presence of facial irritability or tetany are strongly in favour of the diagnosis of laryngismus.

It is important to remember that attacks, which closely resemble those of laryngismus, occasionally occur in atypical whooping-cough in young babies.

If the attacks of laryngismus are at all severe, a guarded *prognosis* must be given. The great majority of cases recover rapidly and completely under treatment, but there is *always* a chance that the next attack—before the treatment has begun to take effect—may be severe and prolonged, and a possibility that the child may die in it.

General Convulsions.—As is mentioned elsewhere (p. 546), spasmophilia is much the commonest cause of infantile convulsions in a city practice in this country. The nature of the case is generally easily recognised owing to the presence of other manifestations of the constitutional abnormality; and suitable treatment of the general condition rapidly removes the tendency to eclamptic attacks. When the fits end fatally, it is usually owing to their being complicated with laryngismus.

Causation.—In considering the obscure subject of the etiology of spasmophilia, we may, in the first place, mention certain clinical facts which bear more or less directly on the question; and, in the second, the results of some pathological and experimental investigations.

Clinical Considerations.—*Heredity* seems to play a certain part in the matter; for occasionally there is a history of the patient's parents having suffered from similar symptoms in childhood, and it is common to find several children in a family affected.

The *age* of the children is of importance. The symptoms are rarely seen in early infancy, and are commonest between six months and three years.

There can be no question that the *nature of the diet* is a most important factor in the etiology. Spasmophilia scarcely ever occurs in this country in breast-fed babies. An excessive amount of cows' milk in the diet favours its occurrence; and starvation for twenty-four to forty-eight hours, and a temporary diet of farinaceous food only, always have a beneficial effect on the symptoms, and generally stop its severer manifestations entirely for a time. The prolonged use of food containing a large proportion of carbohydrates, however, seems to predispose to its occurrence.

The most obstinate cases of tetany are generally met with in thin dyspeptic children, while laryngismus and convulsions are commoner in those who are more or less fat and have no signs of indigestion.

Spasmophilia is so generally associated with the presence of *rickets* that its main manifestations have often been described as the "nervous complications of rickets." The rickets present is usually of a relatively early and progressive type; and it is far less commonly met with in children with advanced bone-changes. Active antirachitic treatment always exerts a very favourable action on the symptoms. The results of recent investigations make it probable that the relation between rickets and spasmophilia is not simply that of cause and effect, but rather that the two morbid constitutional conditions have important etiological factors in common.

Any source of *peripheral irritation*, such as a chill, teething, constipation, or acid dyspepsia, is apt to aggravate the symptoms, probably by increasing the general excitability of the nervous system.

The *season* of the year has a distinct influence on the prevalence of spasmophilia, far more cases being met with in the earlier than in the late months of the year. This may be connected in some way with the cold winds which prevail from January to June, for it has also been found that, in Edinburgh, severe cases of tetany are commoner in those years in which there have been more northerly and easterly winds than usual.[1]

The occurrence of well-marked symptoms of spasmophilia

[1] J. Pirie, *Edin. Hosp. Rep.*, 1893, i., 400.

during the course of a severe *acute illness*, such as pneumonia or measles, is always a cause for anxiety, as it indicates a dangerously lowered resistance.

In cases in which there are recurrent exacerbations of the symptoms, these are often brought on by a fright or by some other *emotional disturbance*.

Pathological Considerations.—It is not necessary here to discuss the large amount of pathological, chemical, and experimental work by which it has been attempted to discover the ultimate cause of spasmophilia, or the various theories which have been suggested to explain its phenomena. A few of the main facts may, however, be briefly alluded to.

The point of most importance with regard to the etiology of tetany is the close connection which has been shown to exist between it and the parathyroids. Escherich[1] and others have held that the spasmophilic symptoms are due to disease of these glands; and, although in view of all the facts there are difficulties in accepting this statement without reservations, it seems certain that disturbance of their functions is always present in spasmophilia. There are, however, certain facts which are very hard to explain. It has been shown that complete removal of the parathyroids always produces tetany in man and in many of the lower animals; also that hæmorrhage and other gross lesions are frequently found in them when tetany has been present. But, it is equally certain that the parathyroids are found to be structurally normal in most cases of tetany, that in some cases with severe parathyroid lesions no indications of spasmophilia have been present during life, and that the administration of parathyroid substance rarely has any effect in relieving the symptoms of tetany.

Although a close relation between disturbance of the parathyroids and spasmophilia must be admitted, the way in which the symptoms are produced still remains obscure. Many theories have been suggested to explain it. M'Carrison[2] points out that one of the functions of these organs is to assist the thyroid in protecting the central nervous system from the action of the toxins of intestinal bacteria, and that their failure to perform this function may occasion the peculiar irritability of the nervous system.

[1] *Die Tetanie der Kinder*, Wien u. Leipzig, 1914, 177.
[2] *The Thyroid Gland*, London, 1917, 25.

Nöel Paton, L. Findlay, and their collaborators[1] are of opinion that the parathyroids have a special influence on the metabolism of guanidin and methyl-guanidin; and they attribute tetany to the accumulation of these substances in the body, owing to the parathyroids being diseased, or inactive from other causes.

The parathyroids are intimately concerned in the regulation of salt metabolism, and it is probable that the disturbance of this function with a resulting diminution of the calcium in the circulation is an important factor in the causation of the spasmophilic symptoms. Howland and Marriott[2] have recently demonstrated, by a new method, that the calcium content of the serum is invariably greatly diminished during the active symptoms of spasmophilia, so as to be little more than half the normal amount and sometimes even less. In other convulsive disorders in childhood they have found no corresponding diminution of the calcium in the serum. They have also found that tetany sometimes results from the administration of large doses of sodium bicarbonate.

Alan Brown and Almon Fletcher[3] have suggested that the nervous excitability of spasmophilia may be due to a disturbance of the normal ratio between the calcium and magnesium salts in the serum, which have a sedative effect, and those of sodium and potassium, which have an exciting influence on the nervous system.

Treatment.—In mild and uncomplicated cases of spasmophilia, a thorough antirachitic regimen—fresh air, suitable diet, cod-liver oil, and phosphorus—is generally all that is required to remove the symptoms rapidly and completely; but, when the condition is severe and complicated by debility and chronic indigestion, or when the major nervous symptoms are present, attention must be given to many other points.

The therapeutic indications are two-fold: (1) to remove the constitutional abnormality by regulation of the diet—mainly on antirachitic lines—and to use means to strengthen the nervous resistance; and (2), while the abnormal excitability still lasts, to ward off and relieve the more serious of the nervous attacks. With this end in view, we try to avoid their exciting causes,

[1] *Quart. Journ. Exper. Physiol.*, 1917, iv., 3 and 4, 315 *et seq.*
[2] *Quart. Journ. Med.*, Oxford, July 1918, xi., No. 44, 289.
[3] *Amer. Journ. Dis. Child.*, 1915, x., 313.

and use hygienic and therapeutic measures to soothe and increase the tone of the nervous system.

(1) *General Management.*—It is generally well in severe cases to begin the treatment with a period of complete or relative starvation for twenty-four hours, and to clear out the alimentary tract with castor-oil or calomel. A few doses of rhubarb and soda may also be useful. The diet must be carefully attended to. In the worst cases, breast milk should, if possible, be given; but, generally, regulation of the bottle-feeding is sufficient. The amount of cows' milk should always be greatly reduced at first, its place being taken by raw meat juice, chicken- or beef-tea, and albumin-water. In older children, scraped raw meat and lightly boiled egg may be given. A small quantity of suitable farinaceous food is also desirable in older children, but a large amount must never be allowed. The bowels should be regulated and fluids freely given to encourage a free action of the kidneys.

While it is most important that the child should have plenty of open air, he must be guarded against exposure to cold winds and chills of any kind.

In some cases massage is useful, and the regular use of a modified cold douche has always a beneficial effect in strengthening the nervous system.

(2) *Prevention and Treatment of Laryngismus, Tetany, and Convulsions.*—It is of great importance that the patient should be kept as quiet and free from anxiety as possible. The frequent bad effect of the removal of these children to hospital has been already referred to. Ward cliniques constitute a real danger in bad cases; I have seen a fatal attack of laryngismus occur in the course of clinical demonstration.

The fact that sudden chills and emotional disturbances are such frequent exciting causes of laryngismus would appear to contra-indicate the use of cold douching in spasmophilia. In my experience, however, the use of carefully managed cold douches is a most useful measure and has a powerfully soothing effect on the nervous system. It often lessens the severity of the spasms in tetany, and wards off attacks of laryngismus and convulsions. The effect of such douches in lessening the frequency of laryngismus attacks is particularly striking; if carefully managed, no harm ever results. In one case of severe recurrent laryngismus when the douches were

begun, the paroxysms occurring each night were reduced at once from twenty to two in number. On their being discontinued, because the child disliked them so much, the former frequency returned and continued until it was again checked by the douches being resumed. The baths were given, night and morning, in the child's own nursery by his mother and nurse, and every precaution was used to avoid unnecessary annoyance. The douche should be given in front of a fire. The child is taken from bed and placed in a bath containing an inch or so of hot water. A jug of cold water (60° to 70° F.) is then poured over his back and shoulders, and he is at once lifted out of the bath and rubbed with a towel till he is dry and warm.

If the attacks are numerous or severe, it is probably always advisable, though often unnecessary, to give a sedative also. Bromides are often used, and calcium bromide (4 grs.) has been specially recommended. Antipyrine, however, in doses of 1 or 2 grs. for each year of life, and chloral, are generally more effectual.

When an attack of laryngismus threatens, the inhalation of ordinary smelling salts is occasionally successful in averting it.

In obstinate cases of infantile tetany the regular administration of calcium chloride, in 5-grain doses, may be tried, or the hypodermic injection of 2 or 3 drms. of 8 per cent. solution of magnesium sulphate. I have, however, had no experience of these measures.

The treatment of convulsions is considered elsewhere (p. 544).

In those cases of tetany which occur during severe intestinal disorders, attention to the original disease is the main indication; the diet must be regulated, laxatives and intestinal antiseptics such as thymol and β-naphthol given, and the stomach and bowel washed out.

CHAPTER XXIII

ON ACETONÆMIA, ACIDOSIS, AND ACID INTOXICATION

OFTEN when we are examining a sick child our attention is arrested by a sweet chloroform-like smell of acetone in the breath. This is sometimes very noticeable; but it may be overlooked because it is obscured by a strong offensive odour as of decaying epithelium and secretions. In many of the cases a similar smell of acetone is noticed in the urine also.

Although these symptoms have long been observed, it is only in recent years that light has begun to be thrown on certain aspects of their pathological chemistry, and on their meaning from a clinical point of view. Our information on the subject is indeed, as yet, far from being complete or satisfactory; and, on many points, even the authorities are not fully agreed; so that it is not easy for the physician to arrive at a confident and well-balanced view of the matter. Still, though much remains doubtful, a number of facts have been gathered which are not only theoretically interesting, but also of real value in practice.

In the following pages I shall try to summarise the most important of these facts.

When there is an abnormal amount of acetone in the blood, we have what is called *acetonæmia*. This condition is worthy of attention, not because acetone is in itself harmful, but because its presence practically always implies that of the other two members of the acetone group, β-oxybutyric acid and diacetic (aceto-acetic) acid; and these, or perhaps only the latter (Poulton[1]), are, under the particular circumstances, a source of danger to health. There is a difference of opinion as to whether the danger of their presence in

[1] E. P. Poulton, *Lancet*, 22nd June 1918, 863.

the blood lies in some special properties they possess, or merely in their acidity changing the normal reaction of the blood. Barcroft [1] defines *acidosis* as "the appearance of acids (exclusive of CO_2) abnormal in kind, or perhaps only in quantity, in the blood; or even a decrease in the bases present—in other words, an increase of acid relative to basic radicles in the blood, CO_2 not being considered." The word may be conveniently used to denote a relatively acid state of the blood from whatever cause it may arise and whether it is producing symptoms or not. *Ketosis* is suggested by Poulton as a suitable term to denote the variety of acidosis caused by bodies of the acetone group. When any form of acidosis has gone so far as to upset the patient's economy and produce morbid symptoms, we have the serious condition of *acid-intoxication.* The cases of acidosis with acid-intoxication which we meet with in clinical work are generally due to acids of the acetone group; but similar symptoms have been produced experimentally in animals by various other acids. There are also clinical types of acid-intoxication (*e.g.*, in uræmia, hepatic cirrhosis, and cholera) which do not depend on the presence of acetone bodies, but on that of other acid substances. Howland and Marriott have recently [2] shown that the acid-intoxication which occurs in some severe forms of diarrhœa in children, is probably, in some cases, due to a deficient excretion of acid phosphates by the kidneys. Needless to say, acetone bodies are not usually present in the urine when the acidosis is due to other acids.

Causation of Acetonæmia.—The lesion on which acidosis depends has not yet been defined, but the presence in the circulation of an abnormal amount of substances of the acetone group always depends on an increased fat-metabolism, along with an insufficiently rapid elimination of these products by the liver and kidneys. The increased fat-metabolism may, theoretically, arise from an increase of fatty matter in the food. It is, however, in most cases not due primarily to this, but to an abnormal diminution of the carbohydrates, or to some interference with their digestion which renders them no longer available for utilisation by the tissues; for, while the usual carbohydrate metabolism lessens the splitting up

[1] Barcroft, *The Respiratory Function of the Blood*, Cambridge, 1914.
[2] Howland and Marriott, *Amer. Jour. Dis. of Children*, 1916, ii., 300.

of the fats, its diminution increases it. Constipation and starvation are found to increase fat-metabolism; and, clinically, it is found that they have the effect of increasing acetonæmia. The starvation alluded to may be brought about by lack of food, or it may arise from continued vomiting or diarrhœa, which have the same effect. The delayed excretion of the acetone bodies may depend to some extent on an idiosyncrasy, or it may be brought about by various passing conditions, such as constipation, sepsis, or the action of certain chemical poisons.

In addition to the dietetic causes of acetonæmia there are certain forms of toxæmia which produce or aggravate it. Examples of these are the poisoning caused by certain general anæsthetics, such as chloroform and ether, that due to salicylic compounds, and that which is caused by septic absorption from appendicitis, or from infected wounds.

Children are far more liable than adults to acidosis and acid-intoxication, and the younger the child the greater is this tendency. The presence of acidosis seems generally of no importance except in so far as it constitutes a possible threat of the graver condition. When acid-intoxication begins, however, it is always a serious matter, which calls at once for investigation and active treatment.

Symptoms of Acid-Intoxication.—When acid-intoxication sets in, the child becomes restless, irritable, and sleepless; he cries out and tosses about in bed, and is heedless of what is going on around him. This condition is apt to pass into one of definite drowsiness, with or without delirium; and in bad cases it may end in coma. Generally there is vomiting, which is sometimes urgent and uncontrollable; and, when this is so, the vomited matter often contains a little blood. The bowels may be constipated, or there may be more or less diarrhœa with mucus, and perhaps blood, in the motions. Some degree of jaundice occasionally occurs. The abdomen is flat, even retracted, and epigastric pain and some degree of abdominal tenderness are often complained of. In slight cases the tongue may be fairly clean, but it is often dry and coated. The pulse is rapid and soft. Toward the end in fatal cases, though acetone may still be noticeable in the breath, it may no longer be found in the urine, and there is often almost complete anuria.

The facies varies with the stage and with the severity of the illness. Sometimes it closely resembles that of grave abdominal disease, but in other cases, even when the symptoms are severe, one is struck by the entire absence of this appearance, at least in the early stages.

Much the most distinctive and interesting of the clinical phenomena in these cases is the peculiar exaggerated form of breathing, or hyperpnœa, which Kussmaul called "air-hunger." In this the respiration is not quickened to any great extent, and there is no cyanosis or other sign of respiratory obstruction; but the breathing is peculiarly deep and laboured, and it has more of a thoracic type than is usual in childhood. In most cases, both the breath and the urine smell strongly of acetone. The relative severity of the different symptoms varies greatly in different cases. When the acetonæmia occurs as a complication of severe organic disease in the abdomen, the symptoms are, of course, modified according to the condition present.

In fatal cases of acid-intoxication, the liver-cells are found to be either in a state of extreme fatty degeneration or otherwise seriously disorganised. The exact relation between this and the blood condition is not as yet fully determined. In one fatal case in which anuria had been present, extensive necrosis of the renal tubules was found, with hæmorrhages into the glomeruli.

Test for Acetone and Diacetic Acid.—It is not now thought to be of any importance to test separately for acetone and diacetic acid. The best clinical test for both is Rothera's. It must be applied when the urine is freshly passed, and is very delicate, as it detects diacetic acid in a concentration of 1 : 200,000, and 1 part of acetone in 20,000. It is as follows:—5 c.c. of the urine is mixed with an equal amount of a saturated solution of ammonium sulphate; 2 c.c. of strong ammonia is added, and afterwards a few drops of a 5 per cent. solution of sodium nitroprusside. If acetone or diacetic acid is present, the liquid acquires a rich purple colour, and the length of the interval before the colour appears, and the intensity of the tint, afford some indication of the quantity of acetone and diacetic acid.

There is, as yet, no clinical test available for the presence of β-oxybutyric acid.

Significance of Acetonæmia.

It is not always easy to say at first what it means when a patient has signs of acidosis. Often it signifies very little indeed that matters, but sometimes it is of serious importance. We may roughly divide the conditions under which this symptom occurs into three groups:—

1. *Physiological Acetonæmia.*—This may arise in some children merely from a temporary inadequacy of the metabolic processes. It may be set up by the child taking too little food, or by his food-stuffs being given in unusual forms or in unwise proportions—too much fat or too little carbohydrate—so that his chemistry is deranged, although probably only in a passing and harmless way.

A curious variety of this sort of acetonæmia was investigated some years ago by R. S. Frew.[1] He examined for acetone the urine of 662 children who were admitted to the wards in the Great Ormond Street Hospital, for all sorts of diseases and injuries, and found it present in no fewer than 408 of the cases (66·1 per cent.). The examinations were repeated daily for three days at least; and although acetone was almost invariably absent on admission, it appeared in the majority after the child had been twelve hours in hospital. It increased in amount for about twenty-four hours, and then diminished; and it ceased without treatment on the fourth day. Whether the child were ill or not, and if ill, what was the matter with him, made apparently no difference. The acetone was present more frequently and in larger amount the younger the child was. Whenever glucose was given, the acetone disappeared within twelve hours.

The explanation suggested to account for this temporary acidosis is that the metabolic processes are so unstable in childhood that they may be upset even by slight changes in the form of the carbohydrates taken. While the full significance of these interesting observations is by no means clear, there is no reason to think that this slight passing acetonæmia predisposes the child who has it to suffer from post-anæsthetic poisoning or any other dangerous form of acid-intoxication. In anxious cases, however, it is probably advisable, in case of mistakes, to delay operation if possible till the physiological

[1] *Lancet*, 1911, ii., 1264.

acetonæmia has either passed off spontaneously or been stopped by the administration of glucose and sodium bicarbonate.

2. *Acetonæmia as a Complication.*—Acetonæmia often occurs as a secondary accompaniment and aggravation of some serious disease, owing perhaps to some toxæmia present, or to the starvation which the disease or its treatment has occasioned. Thus it is met with in various sorts of septicæmia, in diarrhœa, peritonitis, intestinal obstruction, severe vomiting from any cause, poisoning from phosphorus and other drugs, pneumonia, diphtheria, and many other fevers, tuberculous meningitis, spasmophilia, and so on. In these conditions the presence of acetonæmia often does not affect the diagnosis, nor generally, it seems, the prognosis, to any great extent; and the treatment is that of the original disease along with the administration of alkalies, laxatives, and easily assimilable carbohydrates.

3. *Acetonæmia as a Cardinal Symptom of Various Forms of Toxæmia.*—The detection of acetonæmia may be the first thing to reveal the presence of danger in one of the important forms of toxæmia of which acid-intoxication is a grave and cardinal symptom. In such cases the early recognition and prompt treatment of the acid-poisoning are all-important. The main clinical types of which this may be said are:—diabetic acetonæmia, post-anæsthetic acetonæmia, salicylate poisoning, and recurrent or cyclic vomiting. There are probably various other types belonging to this group. For example, Abt has published[1] a series of cases of a very fatal type of acid-intoxication in young infants which differs in many respects from recurrent vomiting.

Diabetic Acetonæmia.

In diabetes the risk of acid-intoxication passing on to coma is particularly great in early life. When treating a diabetic child, therefore, we must constantly be on our guard and try to prevent its occurrence. For this purpose we have to take measures to ensure a regular action of the bowels, but at the same time check any tendency there may be to diarrhœa, and the urine should be kept mildly alkaline. We must also see that the carbohydrates in the diet are not too much cut down, and that an excess of fat is not given (for example, in the form of cod-liver oil).

[1] *Amer. Journ. Med. Sci.*, 1914, cxlvii., 1, 86.

When signs of acid-intoxication appear, vigorous measures are called for. A purgative should be given at once, and also bicarbonate of soda by the mouth in doses of 30 grs. every two hours in a tablespoonful of water, or, if the vomiting is severe, by rectum (2 drms. in 8 oz. of water every six hours). In extreme cases a few ounces of a 5 per cent. solution of sodium bicarbonate may be injected into a vein.[1] It is also advisable to increase the child's fluids by the subcutaneous injection of saline solution. A few ounces of a 10 per cent. solution of glucose may be given by mouth or as an enema. The child must be carefully guarded from excitement and from all other causes of exhaustion.

Ordinary stomach sedatives are of little or no use in allaying the vomiting, but a small hypodermic of morphine is sometimes helpful. Of this, $\frac{1}{20}$ gr. may be given to a child of three or four, and $\frac{1}{10}$ gr. to one of ten years.

Post-Anæsthetic Acetonæmia (*Delayed Chloroform Poisoning*).

In this country attention was first drawn to the danger of post-anæsthetic acetonæmia by Leonard Guthrie;[2] and further light has since been thrown on the subject by the investigations of Stiles and Stuart M'Donald,[3] Beesly,[4] Langmead,[5] and others.

The administration of chloroform, ether, or any other general anæsthetic always induces some degree of temporary acetonæmia. This occasionally leads to acid-intoxication, and is, therefore, not without danger, even in apparently healthy children; and it may be fatal, unless the kidneys are unable to respond to the increased formation of acetone bodies by a correspondingly increased excretion. Ether is much less harmful in this respect than chloroform, because, although it produces a somewhat greater degree of acetonæmia, it does

[1] This solution must not be given subcutaneously, because, when it is sterilised by boiling, some of the bicarbonate is changed into carbonate, and this, though well borne by the veins, is very irritating to the subcutaneous tissues.

[2] *Lancet*, 1894, i., 193 and 257; 1903, ii., 10.

[3] *Scot. Med. and Surg. Journ.*, August 1904, 97.

[4] *Brit. Med. Journ.*, 1906, i., 1142.

[5] *Brit. Med. Journ.*, 1907, ii., 819.

less damage to the cells of the liver and kidneys, and therefore interferes to a smaller extent with their powers of rapid elimination.

The symptoms, which resemble those in other types of severe acute acid-intoxication, may come on within a few hours of the anæsthesia, or their appearance may be delayed for as much as three days. The amount of the drug used, and the duration of its administration, seem to have little or nothing to do with the occurrence of poisonous symptoms. If the urine contains acetone before an operation, this is usually of no importance, provided the condition is not of the severe and acute type. Indeed, Beesly has made the interesting suggestion that the antecedent presence of chronic acetonæmia, may even be of advantage, because it has accustomed the liver and kidneys to the elimination of acetone. If it is of the acute type, however, the danger is certainly great, especially if chloroform is the drug which has been used. When acetonuria and symptoms of acid-intoxication are found after an anæsthetic has been administered, the prognosis must always be guarded, for this form of acid-poisoning is very dangerous. The risk is naturally much greater when septic conditions are present as in appendicitis, so that, in these, ether should always be preferred to chloroform. In all cases the idiosyncrasy of the patient has probably a large share in determining the degree of danger. When the patient has suffered from attacks of recurrent vomiting, special precautions should always be taken.

Treatment.—When such symptoms set in after the administration of an anæsthetic, the same measures are to be taken as in diabetic acetonæmia, and they must be begun energetically at once.

If there is any reason to anticipate danger from anæsthetic poisoning, the following *precautionary measures* may be taken:—

1. For two or three days before the operation, the patient should have bicarbonate of soda in sufficient doses to render his urine alkaline.

2. During the same time, the fat in his food should be diminished as far as possible, and he should have plenty of carbohydrates.

3. A few ounces of a 10 per cent. solution of glucose may

be given by mouth several times a day in place of less easily assimilable carbohydrates; and, two hours before the operation, an enema of the same solution.

4. The child must be carefully guarded from excitement, anxiety, and fright.

5. The urine should be tested for acetone; and if any is present it would probably be advisable to delay the operation until further examination has made it certain that the condition is not of an acute and dangerous type.

Salicylate Poisoning.

Generally salicylates, even in large doses, are well borne by children. The depressing effects that used to be feared from their use rarely occur, and, when they do, are not usually dangerous; and the headache and tinnitus aurium which adults often suffer from, are scarcely ever complained of. In some children, however, there is a real danger of poisoning from salicylates (or aspirin), and the symptoms produced are those of acid-intoxication—restlessness, vomiting, thirst, air-hunger, delirium, and drowsiness—and these may end in coma and death. In children who have this idiosyncrasy, quite a small dose of the drug is sufficient to produce the symptoms, unless proper precautions have been taken. The main precautions necessary are the careful regulation of the bowels by aperients and the administration of bicarbonate of soda along with the salicylate and in twice the quantity.

Treatment.—Whenever any signs of air-hunger and drowsiness set in in a child who is on salicylates, the drug must be promptly stopped, a purgative given, and bicarbonate of soda continued in doses of 30 grs. every hour or every two hours. This is usually successful, and in from twelve to twenty-four hours after the symptoms have subsided, the salicylate may safely be begun again in smaller doses, and gradually increased. When this is done the symptoms do not usually recur, even with fairly large doses. Evidently in this form of acetonæmia the liver and the kidneys are little if at all damaged and soon acquire the capacity to deal with an excess of acetone.

Recurrent Vomiting (*Cyclic Vomiting*).

The name of recurrent vomiting is given to a fairly well-defined group of cases of obscure origin in most of which attacks of sudden severe vomiting recur at varying intervals, generally without any obvious cause, and are accompanied by acetonæmia, and occasionally by grave acid-intoxication.

Clinical Features.—In many cases the disease, though distressing to the patient, gives rise to no anxiety, the vomiting is not severe, and the attacks have little effect on the child's health. The mother, who has become accustomed to them, and probably calls them "bilious turns," may not even think it necessary to summon a doctor. In others the frequently returning sickness is so severe, and the patients are so seriously weakened by it, that for the time they become chronic invalids.

In a few instances the attacks, after beginning in the usual way, rapidly develop signs of acute acid-intoxication, and the child is soon in a state of great danger. These alarming symptoms may set in without any warning in children in whom former attacks have always been quite mild in character. This is at times so striking as to suggest the probability that the entirely altered character of the illness is due to a complication which has not occurred on the other occasions. In more than one case, for example, a very severe attack of this kind seemed to be due to a coincident influenza which afterwards spread through the family.

The disease is mainly one of childhood, and in most cases the attacks are said to have begun in early infancy, or at least within the first three years. Sometimes, however, they occur for the first time in the sixth or eighth year, or later. So far as I know, however, it is only in young children that the condition is really dangerous. Although the children not uncommonly seem quite healthy in other respects, in many of the worst cases they are said to have always been delicate. They are often obviously neurotic; and I have found in several a history of their having had asthma, urticaria, eczema, or stammering. In many of them uric acid crystals, or a copious deposit of urates, have been noticed in the urine. I have seen two instances in which patients who had suffered from pyloric stenosis in early infancy developed this disease in later childhood. This may have been merely a coincidence, but F. W.

Shaw[1] and A. E. Russell[2] have published cases of recurrent vomiting in which pyloric hypertrophy was found post-mortem.

The disease is commoner in private than in hospital practice, and it occurs specially in the children of gouty and neurotic parents. Sometimes more than one child in a family is affected. The patients are rather more frequently girls than boys.

The intervals between the attacks vary greatly in duration in different cases, and sometimes also in the same case at different times. They may for a time return as often as every fortnight, more often every one, two, or three months; sometimes they occur only once or twice a year. The attacks may continue for many years, but generally they tend to cease as the child grows older and stronger.

Symptoms of the Attacks.—In many instances the attacks set in without any warning. In others the mother is forewarned by the child becoming pale, tired-looking, and irritable, yawning a good deal and refusing food. Sometimes there is flushing, but more often a feeling of chilliness is complained of. Occasionally there are local symptoms, such as headache, or pain in the neck or limbs, or in the pit of the stomach. In one or two of my cases there was antecedent diarrhœa; much more frequently, however, the patient had been troubled with constipation; flatulence is a common symptom. When such indications of a threatened attack occur, they may last for from twelve to twenty-four hours before the actual vomiting begins.

The vomiting, when it comes, is often very severe and distressing; and everything, even small quantities of water, may be rejected. The ordinary treatment of dyspeptic vomiting has no effect. At first the vomited matters consist of food, mucus, and bile; and, later, there is often some blood in it. The child is drowsy, restless, and thirsty, and may complain of severe headache. The temperature sometimes remains normal, but generally it rises to 101° or 102° at least, and it often reaches 104° or even 105°. There may be vague abdominal pains, but no definite localised tenderness is to be made out. The abdomen, in uncomplicated cases, is flat or retracted. Occasionally there is diarrhœa, but generally obstinate constipation. The tongue is furred, and the pulse

[1] *Brooklyn Med. Journ.*, 1903, xvii., 211.
[2] *Proc. Roy. Soc. Med.* (Dis. of Children Sect.), 1910, iii., 4, 78.

weak and rapid; the patient usually looks very ill. Acetone is generally, if not always, to be detected in the breath and in the urine at some stage of the attack. The urine may also contain a small quantity of albumin or blood and a few hyaline casts. Rarely there is a degree of jaundice.

The vomiting and other symptoms generally subside, often suddenly, about the third day, but they may continue for six or seven days, or longer.

The serious cases, in which acid-intoxication appears, closely resemble those of diabetic acetonæmia, and they generally respond to the same treatment; but a large proportion of them end fatally. I have had the misfortune to have had four cases of this kind, which died in spite of energetic treatment. One of the patients was eighteen months old, one two years, and the others both about five years.

Occasionally cases are met with in which there is little or no vomiting; and, in some, recurrent pyrexia with, or without, headache is the main symptom. These cases are probably of the same nature as those of recurrent vomiting, and they should be treated in the same way.

Causation.—The pathology of recurrent vomiting is still obscure. The view at present held is that it depends on a "poisoning arising from the intestinal tract with resulting imperfect oxidation of the fats and their accumulation in the liver."[1] It is important, however, to emphasise the fact that it is in children of specially neurotic constitution that this is apt to occur; and we shall also probably not be far wrong if, with Holt and Rachford,[2] we regard lithæmia as having a good deal to do with the causation of the disease. This view is often supported by the result of treatment. There seem to be no good reasons for suspecting morbid conditions of the appendix as a frequent cause of the attacks, for I have known several cases in which, after its removal, the symptoms continued recurring just in the same way as before the operation. The cases in which serious symptoms set in, seem always to be due to acid-intoxication, and this usually, if not always, depends on acetonæmia.

Definite exciting causes of the attacks are generally absent

[1] Ewing, *Studies from the Department of Path., Publications of Cornell Med. Coll.*, 1908, viii.

[2] *Neurotic Dis. of Childhood*, New York, 1905, 217.

so far as can be observed clinically; but, now and then, we find that their recurrence has been precipitated by a chill, an indiscretion in diet, some form of exhaustion or over-exertion, or a feverish illness such as influenza.

The disease seems, in most ways, to be closely allied to migraine. A history of sick headaches, asthma, and eczema, or of vomiting attacks, in the parents or near relatives, is not uncommonly obtained; and I have known a number of instances in which the children themselves developed migraine in later life. In this disease also, as in migraine, there is also a family history of gout, as well as of various other manifestations of an unstable nervous system.

Prognosis.—As has already been indicated, this is generally good, and especially so in older children; but in view of the possibility of acid-intoxication occurring, it must always be guarded. There is a considerable likelihood that the attacks may continue to occur for some time; but, generally, under treatment they diminish in frequency and severity, and they often cease altogether. As has been previously mentioned, there is a tendency to spontaneous recovery about the time of puberty, if not before, though the symptoms may then pass into those of ordinary migraine.

Diagnosis.—A first attack is apt to be mistaken for one of meningitis, of acute gastric catarrh, or of intussusception. Attention to the history of the case and to the symptoms should generally suffice to exclude these conditions. Other diseases which sometimes closely resemble recurrent vomiting are chronic or relapsing appendicitis and some forms of abdominal tuberculosis with acetonuria. In these, also, the history of the case is helpful, and the presence of tenderness and other local signs is usually sufficient to enable a correct diagnosis to be made. The mere presence of acetone in the breath and urine is not in itself of much assistance, as it is so often found in other morbid conditions with vomiting.

Treatment.—When an attack begins, the patient must be kept in bed, and the bowel should be emptied by a purgative, and, if that is vomited, by an enema. In most cases decided improvement follows the administration of bicarbonate of soda in large quantities (120 to 180 grs. or more in the day), as was first pointed out by Edsall.[1]

[1] *Amer. Journ. Med. Sci.*, 1903, cxxv., 629.

So long as the violent vomiting continues, all food by the mouth, including liquids, should be withheld. Sometimes, however, after the attack has lasted for a while, a soothing and settling effect may be obtained from washing out the stomach, or from the administration of a large drink of warm water and soda, which is generally vomited immediately. Occasionally, if there is no suppression of urine, an injection of morphine may be of service. Saline enemata, if retained, have the great advantage that they relieve the distressing thirst from which the patient suffers, and encourage the action of the kidneys.

During the intervals between the attacks, a great deal can often be done to lessen their frequency and severity. The diet should be carefully regulated and all over-eating prevented. Excess of fat in the food must also be avoided; little butter is to be allowed, and no cream; in bad cases the patient's milk had better be skimmed. Green vegetables and fruit in moderation are generally beneficial. A cupful of hot water, on waking in the morning, with or without the addition of Vichy water, is useful.

Great improvement sometimes follows the use, for long periods, of salol (2 to 3 grs.) or salicylate of soda (3 to 6 grs.), with bicarbonate of soda (5 to 10 grs., according to age). These should be given with plenty of water thrice daily, about an hour before meals, and should be continued for weeks. The regular action of the bowels must, of course, be most carefully attended to. In a few cases this treatment has no good effect, but I think that it is always worthy of a careful trial. It may very naturally be asked whether salol and sodium salicylate, even in such small doses, might not aggravate the tendency to acid-intoxication. I have, however, given these drugs so often in cases of recurrent vomiting with obvious benefit, and never with any bad result that I know of, that I feel sure that there is no risk in their use in this disease. The acid-intoxication of salicylate poisoning is much less dangerous than the other severe types of the condition; and it seems quite probable that the administration of small doses of salol or salicylate may not only do no harm, but may even be helpful by training the liver and kidneys in the elimination of acetone bodies.

In addition to dieting and the use of medicines, it is always important, if possible, to avoid all causes of exhaustion, such as prolonged excitement or a long railway journey.

CHAPTER XXIV

ON THE HEART AND CIRCULATION

THE most characteristic peculiarity of the child's circulation is its great readiness to react to all sorts of stimuli—physiological as well as pathological—by quickening, slowing, or irregularity of action, and by changes in the sounds and in the size of the heart. In childhood, therefore, alterations in the pulse, heart sounds, or dullness, such as might give cause for anxiety in an adult, are often due to mere passing phases of action which are of no practical importance. We may not be always able to explain how these changes are produced; but prolonged and careful clinical observation has shown that they do not imply any real weakening of the heart, and consequently, that they call for no special treatment and especially for no restriction of the child's ordinary movements and habits.

Another point to be borne in mind in examining children's hearts is the relatively wide limits of the normal in the matter of such physical signs as the rate of the pulse, the position, of the apex-beat, and the size of the heart as ascertained by percussion. These may vary considerably in different children, without there being any good reason for suspecting either threatened heart-failure or general ill-health.

The Pulse.

In the new-born child, the pulse-rate usually varies fom 120 to 140 in the minute. The following may be regarded as about the average rates in older children during sleep or perfect quiet:—

6 to 12 months . . .	116 to 104.
2 „ 6 years . . .	104 „ 90.
11 „ 14 years . . .	84 „ 76.

The pulse may be quickened as much as twenty or thirty beats in the minute by mental emotion or bodily exercise. It

is therefore of great importance to count its beats when the child is quiet and not frightened, or, if possible, while he is sleeping, as well as after exercise or excitement.

Some of the characters of the pulse are well demonstrated by the sphygmograph; and good tracings may be taken from the radial artery even in young babies.[1] The best instrument

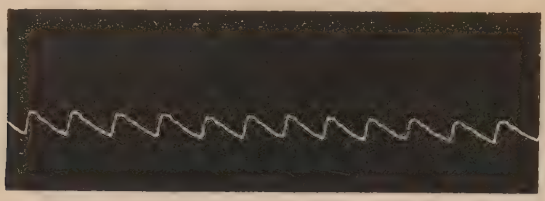


FIG. 134.—Pulse of normal infant of 6 days.

to use is Dudgeon's, and it should be held in position by a soft piece of elastic, instead of by the stiffer band often supplied by the makers.

In new-born children the pulse is very small, even for the size of the child, and the tracing shows the characters usually attributed to a relatively high arterial pressure. Its main peculiarities are that the up-stroke is somewhat slanting and

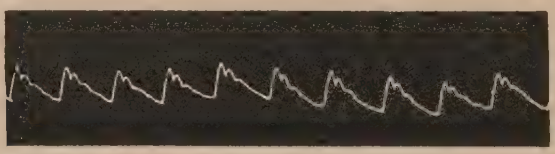


FIG. 135.—Pulse of child of 4 months.

that the dicrotic notch stands high on the down-stroke (Fig. 134). It recalls the tracing of aortic stenosis or that of some aneurism cases. After the first few months of life the volume increases and a double summit develops (Fig. 135). The high-pressure

[1] See Dr H. O. Nicholson's articles on "The Pulse" in the *Encyclopædia Medica*; "On the Pulse in Infancy," *Scottish Med. and Surg. Journ.*, May 1901, 419; and "On the Pulse in Pneumonia in Children," in the *International Clinics*, 11th series, 1902, iv., 122. Dr Nicholson has kindly allowed me to use the accompanying sphygmographs, which were all taken by him from patients of mine, and most of which have appeared in his *Encyclopædia Medica* article.

type persists throughout the whole of the first year. At this age dicrotism is rarely produced even by a very high temperature (Nicholson) (Fig. 136).

In children, the vagus is very sensitive to ordinary physiological stimulation, and normal irregularities of the pulse are therefore common. One example of this is the quickening of

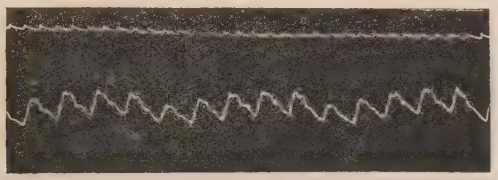


FIG. 136.—Pulse of child of 11 months. Temperature 105° F. No dicrotism.

the pulse-rate during inspiration, with slowing during expiration, which occur when long slow breaths are taken. This effect of the respiration on the rate of the pulse is more distinct in children than in adults; and, according to Mackenzie,[1] its presence indicates a healthy state of the heart.

An allied phenomenon is the irregularity of the pulse which we frequently meet with in healthy children during sleep and

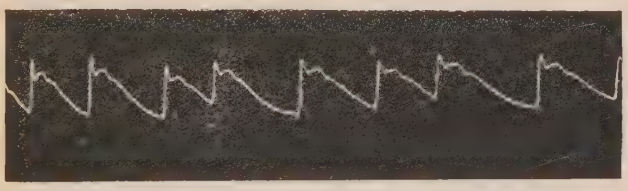


FIG. 137.—"Youthful type" of intermittent pulse in child of 2 years, with mild apical pneumonia. Did well.

also while awake, but also especially during recovery from any feverish illness. This irregularity is always of the "youthful type," that is to say, the diastolic periods of the cardiac cycle are of varying lengths, while the systolic periods remain of approximately equal duration (Fig. 137); and increased rapidity of the heart's action makes the pulse more regular because, the diastolic periods being shortened, their inequality becomes

[1] *Principles of Diagnosis and Treatment in Heart Affections*, London, 1916, 143.

less noticeable. Some individuals, and some families, are particularly prone to a high degree of this irregularity of the heart's action, but it is probable that it occurs in all children at one time or another; and its presence is to be regarded, not as a sign of disease, but actually as an indication that the heart-muscle is in a healthy condition. Its occurrence is certainly compatible with more than average athletic vigour.

The extra-systole or adult type of intermittency—in which the duration of the ventricular systole is variable (Fig. 138)—which is the common type in later life—is only occasionally met with in childhood. It may be met with in cases of heart-failure, but it is generally compatible with good health.

It is most important to recognise the harmlessness of the "youthful type" of pulse irregularity, because when this is

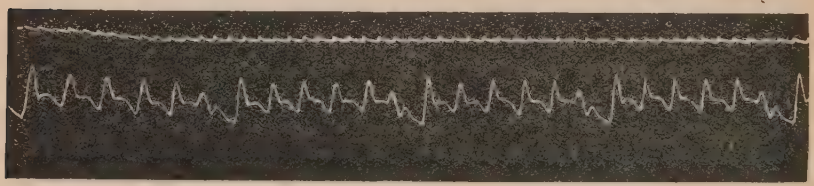


FIG. 138.—"Adult type" of irregularity in child of 5 years.

not understood serious mistakes in prognosis and treatment are often made. During the last twenty years I have watched a number of growing boys and girls who for long periods had been treated as invalids because they showed a well-marked form of this irregularity, with or without functional cardiac murmurs, but without any other indication of disease in the heart or elsewhere. I used to be afraid of allowing these children to take the usual amount of exercise, believing that the irregular pulse must owe its presence to something which was a source of weakness, and that there was therefore a danger of heart-failure, unless special precautions were taken to limit the child's energies. The experience of years has gradually dispelled these anxieties, and proved that they were groundless. Some of the children referred to transgressed rules to a more or less considerable extent, yet none of them ever showed any sign of heart-failure after so doing; and in no single case did the heart symptoms develop into anything really

serious. I am therefore prepared heartily to endorse Mackenzie's authoritative statement that "murmurs and irregularities may be manifestations of a perfectly healthy heart in the young."[1]

In disease, as in health, the tendency to variability is a marked characteristic of the child's pulse. It is greatly quickened by fever, and when the temperature falls, it becomes slow, and often at the same time irregular. In infants the pulse is not slowed by jaundice as it is in adults.

A very rapid pulse is often a help in the early diagnosis of scarlet fever. Generally, however, mere rapidity of the pulse has a much less serious significance in early than in later life.

Paroxysmal Tachycardia.—This obscure condition is very rare in children, but a few typical cases have been recorded.[2] Probably the youngest of these, a previously healthy boy of two and three-quarter years, was observed by R. Hutchison and J. Parkinson. He had four distinct attacks within as many months, with a pulse-rate between 215 and 245. When last seen, he had kept well for four months.

The *prognosis* is generally serious, but it seems to depend on the duration of the attacks. Sometimes complete recovery takes place. Herringham's patient, for example, is reported by Sutherland to have been alive and working eighteen years after. If the attacks are severe, however, and last long, dilatation and heart-failure may occur and the case end fatally. In one case, a girl baby of seventeen months, the tachycardia was noticed on the fourth day of a slight general (? influenzal) catarrh—the pulse ranging from 208 to 215. Under treatment there was only slight temporary improvement, and the child died of heart-failure two days later, with great dilatation and with enlargement of the liver.

The *treatment* of tachycardia by cardiac stimulants and sedatives is as unsatisfactory in children as in adults.

Pulse in Meningitis.—A slow and irregular pulse is frequently found in the early stages of tuberculous meningitis.

[1] "Some Manifestations of a Healthy Heart in the Young," *Brit. Med. Journ.*, 21st Dec. 1912, ii., 1697.

[2] Herringham, *Trans. Clin. Soc. Lond.*, 8th Jan. 1897, xxx., 99; Merklen, *Soc. méd. des Hôp.*, 10 Mai 1901; R. Hutchison and John Parkinson, *Brit. Med. Journ.*, 1914, i., 534, and *Proc. Roy. Soc. Med.*, 1914, vol. vii., Med. Sect., 117; G. A. Sutherland, *The Heart in Early Life*, 1914, 80.

Slowness and irregularity being, however, common in healthy childhood, this alone cannot be regarded as diagnostic. When we also find the artery contracted so that it rolls under the finger, this is an important additional indication; and if the pulse remains slow and irregular when the temperature rises, this is also most significant of intracranial disease (Fig. 139). Under two years of age, marked slowing and irregularity

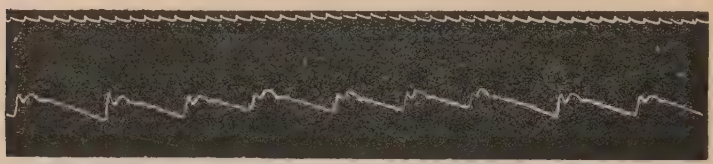


FIG. 139.—Pulse in tuberculous meningitis. Child of 3½ years. Radial artery contracted.

of the pulse is less frequently found in tuberculous meningitis than it is in older children. In these young children the great irregularity of the respiration is even more characteristic than that of the pulse.

In posterior basic meningitis the pulse is usually neither slow nor irregular, and shows no marked contraction of the artery. During the later stages of tuberculous meningitis in

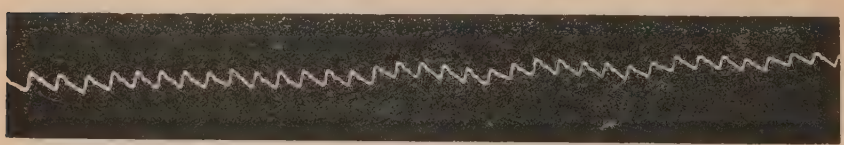


FIG. 140.—Very rapid pulse in last stage of tuberculous meningitis. Child of 2½ years.

young children, a very rapid pulse is often met with, the rate of which varies greatly in different quarter-minutes, although no distinct irregularity is detected by the finger alone (Fig. 140).

Pulse in Pneumonia. — The character of the pulse in pneumonia in children generally forms a far better guide both to prognosis and treatment than do the physical signs in the lungs. Great lowering of the blood pressure is apt to occur especially in broncho-pneumonia. When this happens

in older children, and even in babies in bad cases, the pulse becomes dicrotic and finally monocrotic (Figs. 141 and 142).

A rapid pulse with falling blood pressure is a matter of grave omen. Should the pressure fall so low that the pulse

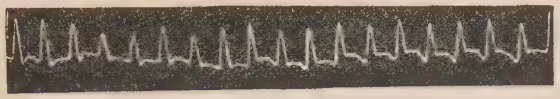


FIG. 141.—Pulse in broncho-pneumonia ; of fatal significance if it persists for several days. Child of 21 months.

becomes monocrotic early in the case, or should this condition remain for several days, it is a very fatal sign.

Pulse in Nephritis.—Very high tension of the pulse in nephritis is rare in little children. It is more common in

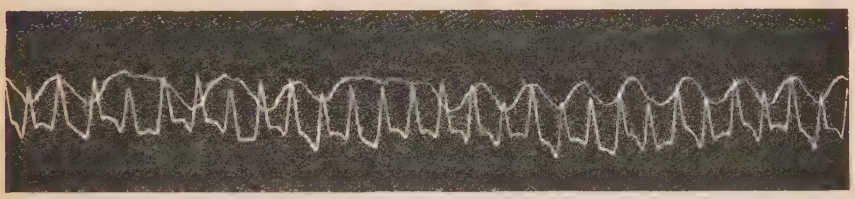


FIG. 142.—Monocrotic pulse from fatal broncho-pneumonia. Pulse 160. Respiration 76. Temperature 104° F. Child of 6½ years.

them to find a fairly normal tension. A low tension pulse in nephritis is a bad sign in children as it is in adults.

The Heart.

Whatever a child's complaints and symptoms may be, we can never safely omit a careful examination of his heart ;[1] for some defects in that organ cause no subjective symptoms whatever, and need a local investigation to reveal them. The physical signs connected with the heart are only of importance in so far as they teach us something about the state of its structure, and especially about the way it is doing its work. We have to gather from them, not only whether the valves

[1] See Dr D. B. Lees' interesting address on "The Heart of the Child" in his work on *The Treatment of Some Acute Visceral Inflammations, and Other Papers*, London, 1904, 252.

are competent, but whether the heart is normal in position, in shape, and in the size and strength of its different parts; also whether there is any pericardial effusion.

Inspection.—In cases of hypertrophy of the heart in children, there is often considerable bulging of the soft chest-wall, and abnormal pulsations are more easily visible than in adults. *Venous pulsation* above the clavicle is common, especially when the children are lying; and it usually has no serious significance at all.

Palpation.—Palpation is relatively much more important in young children than in adults; and, by its means, cardiac hypertrophy and dilatation can usually be estimated more satisfactorily and accurately than by percussion.

The exact position of a normal apex-beat is often difficult to determine; and it may vary considerably in different children, and also in the same child at different times and in different postures. In children under four years, it is generally situated outside the nipple-line, in the fourth intercostal space. This is because the heart lies more horizontally than in later life. As the child grows older, the apex-beat is oftener found in the usual adult position. It may be displaced to one or other side by pleural effusions, or upward by pericardial effusion or extreme abdominal distension. In palpating we have to notice not only the position but also the degree of force of the apex-beat, and whether it is well-defined, as in hypertrophy of the left ventricle, or diffuse as in enlargement of the right.

Distinct *pulsation* of the right ventricle in the *epigastrium* is always a most important sign. It means either displacement of the heart to the right, disease of the left ventricle, congenital heart-disease, or, very often, that the right heart is dilating as the result of lung or kidney disease and is threatening to fail. The *liver-edge* should always be palpated at the same time as the apex, as hepatic enlargement from venous engorgement is a common and important accompaniment of heart-failure. *Thrills* are easily felt in children; and their character and distribution are important in diagnosis, especially in the case of congenital heart-disease.

Percussion.—Percussion is useful in childhood, though its results are often less definite and less easily interpreted than those of palpation. It is never necessary to percuss otherwise than lightly, or to use anything but the fingers.

To judge of the size of the *left ventricle*, we percuss the heart's left border, which usually lies half a finger-breadth or so to the left of the apex-beat. When, as sometimes happens, the left border is rapidly displaced outwards, so as to reach two or even three finger-breadths beyond the nipple-line, this indicates *dilatation of the left ventricle.* The diagnosis is confirmed by finding a feeble pulse, a feeble and diffuse apex-beat, a weak first sound at the apex, and accentuation of the pulmonary, and often also of the aortic second sound. Such dilatation indicates an urgent danger of syncope. It is to be watched for in such debilitating diseases as influenza and enteric fever, and especially in acute rheumatism and in diphtheria, both during and for some weeks after the throat affection. It is to be treated by keeping the patient lying flat for weeks.

The *right auricle* forms the right limit of the cardiac dullness and reaches from a half to one finger-breadth to the right of the sternum in the fourth space. When it is dilated, the dullness may extend two finger-breadths or even more from the sternum in this space, and from a half to one and a half in the third.

Great distension of the right auricle is an urgent danger-signal as it threatens death from asphyxia. It calls for immediate relief by means of leeches, venesection, or otherwise (p. 805).

Auscultation.—The normal heart-sounds in little children are peculiar in certain ways. The first sound is often louder than the second in all the areas, so that even over the base of the heart the rhythm is trochaic and not iambic as in adults. The pulmonary second sound at the base is normally louder than the aortic. We have, therefore, to judge of the strength of the pulmonary second sound by comparing it with the first sound in the same area; and, only when the second is constantly the louder of the two sounds there, is it to be regarded as accentuated.[1] The heart must, however, be auscultated when the child is not frightened, because emotional disturbance normally causes a temporary accentuation of the pulmonary second sound.

Owing to the favourable conditions for conduction offered

[1] C. Hochsinger, *Die Auscultation des kindlichen Herzens*, Wien, 1890, 13.

by the thorax in children, the heart-sounds are heard more widely over the lungs than in adults.

Functional Peculiarities of the Heart Signs.

Unusual physical signs, such as *murmurs* or an *increase in the heart's dullness with outward displacement of the apex-beat*, often indicate the presence of an acquired valvular disease or some congenital malformation; but this is by no means always the case. These signs, like the pulse irregularities already referred to, although unusual, are not necessarily abnormal; that is to say, they do not always indicate the presence of disease or even debility.

Functional murmurs are invariably systolic in time, and soft and blowing in character. They may be heard over the base or at the apex, but are commonest over the mid-sternum. Their loudness varies at different times and under different conditions; they are sometimes best heard when the patient has been resting, and sometimes after exertion; sometimes in the prone and at others in the erect, position. Their occurrence may be due to the presence of anæmia or to some dilatation of the heart. Often, however, we meet with well-marked murmurs when the blood is quite normal and no evidence of dilatation is present. These murmurs may also be noticed to come and go, without any corresponding changes in the size of the heart being demonstrable. The causation of these functional murmurs is not as yet understood; but it is certain that, in many cases, they are physiological phenomena which do not indicate the presence of anything that interferes with the heart's fitness for its ordinary work.

The question as to what extent an increase in the heart's dullness and an outward displacement of its apex may occur within the limits of perfect health, is one which cannot, as yet, be answered dogmatically. There can be no doubt, however, that small differences in these matters are of little moment, and that we should always be slow to lay much stress on even a considerable divergence from the usual, unless it is accompanied by obvious signs of hypertrophy of the heart muscle, persistent quickening and weakening of the pulse, or other indications of impaired function.

I have followed for years the cases of many children who

had more or less well-marked functional murmurs, and have watched not a few of them through adolescence. In some there has been little change in the sounds to note; in others the character of the murmur has altered; in many, it has entirely disappeared as the patient grew up.

In determining the question whether unusual physical signs do, or do not, indicate real disease or debility of the heart, our most important guide is the extent to which the heart is able to meet the strain of extra exertion without showing signs of failure. To ascertain this, we enquire as to the usual effect of exercise on the child; and we can sometimes ascertain it for ourselves by allowing the patient, if an older child, to run up stairs, or jump, or lift a weight, or if a baby, to scream and struggle, after we have made our examination. We then examine him again and note the effect of the exertions on his subjective sensations, breathing, colour, and pulse, and on the sounds and apex-beat of the heart.

Congenital Malformations of the Heart.[1]

Causation.—Congenital malformations of the heart may represent an arrest in the growth and development of various normal parts of the organ, or an abnormal persistence of certain fœtal structures which should have disappeared in the course of intrauterine life. Until recent years, many of the lesions found, such as thickening and puckering of the valves and adhesion of their cusps, were regarded as the result of intrauterine endocarditis; but A. Keith[2] has shown that this was probably a mistake, and that these changes, like most of the congenital deformities met with in other parts of the body, are due to an obscure non-inflammatory process. The frequent co-existence of such malformations elsewhere, along with defects in the heart, is strongly in favour of this view.

We know very little, as yet, of the conditions under which arrests of development take place, but probably anything that interferes with the mother's health during the earlier stages of her pregnancy may favour their occurrence. One interesting

[1] Maude E. Abbott, *Osler and McCrae's System of Medicine*, 1908, iv., 323.

[2] "On Malformations of the Human Heart," *Lancet*, 1909, ii., 359, 433, and 519.

fact, first pointed out by A. E. Garrod,[1] is the curiously large proportion of cardiac, as well as other malformations which are found in cases of mongolism (p. 678). While it is probable that any form of debility in the mother may predispose to cardiac malformations in the child, there seems to be no good reason to regard either syphilis or rheumatism as of special importance in this connection. It is not very uncommon to find more than one case of congenital heart affection in the same family.

Clinical Phenomena.—The main symptoms and physical signs by which we recognise the presence of congenital malformation of the heart may be divided into three groups:—(1) Cyanosis, which is usually accompanied by polycythæmia and increase of the hæmoglobin in the blood, and often also by clubbing of the fingers and toes. (2) Peculiar physical signs on inspection, palpation, percussion, and auscultation, which are generally quite different from those produced by the action of endocarditis on a previously normal heart, and (3) various indications of circulatory disturbance, such as general debility, infantilism, dyspnœa, and heart-pain; also, occasionally, recurrent epistaxis and epileptiform seizures of various types.

In several forms of malformation no symptoms at all may be present, or only cyanosis, a murmur, or debility be noticed. In some cases, the chief clinical signs may first appear about the time of puberty, when the rapid growth of the body is throwing an increased amount of work on the malformed heart.

1. **Cyanosis** is the most characteristic symptom of congenital lesions of the heart. Still found it present in about one-third of his cases. In 136 of my cases, sixty-three were cyanosed either at birth or later; while, in the remaining seventy-three, no cyanosis was present on examination. This probably, however, overstates the real proportion of cyanosis, for cases of cardiac malformation without cyanosis are often overlooked, while those in whom it occurs are almost sure sooner or later to find their way to the physician.

The amount of discoloration varies greatly in different cases, and its degree is generally, though not always, an index of the severity of the case. It may be present from birth, or may only begin in the later stages of the case. Severe cyanosis never results in young children from ordinary endo-

[1] A. E. Garrod, "On the Association of Cardiac Malformations with other Congenital Defects," *St Bart. Hosp. Rep.*, 1894, xxx., 53.

carditis; and any cyanosis that occurs in that disease is always accompanied by indications of severe heart-failure.

The occurrence of cyanosis is probably due to a variety of factors. The deficient aëration of the blood, which may arise either from admixture of venous and arterial blood through abnormal openings, or from venous stasis, is probably the chief of these; but there can be little doubt that the great enlargement and new formation of the capillaries in the skin and elsewhere, and the deep tint of the blood also play an important part in the causation of the cyanosis.

In some children who are habitually cyanosed, and also not infrequently in others who ordinarily show no cyanosis, peculiar paroxysmal attacks of blueness sometimes occur. More or less severe seizures of this kind were observed in 10 per cent. of my cases of congenital heart-lesion. They are usually accompanied by severe dyspnœa and pain of an extremely distressing character. They often set in as a result of dyspepsia and flatulence, and they may end in syncope or convulsions, or even in death. These attacks will be further referred to when we come to deal with heart-pain.

Polycythæmia.—Along with cyanosis, there is usually an increase in the number of the red blood-corpuscles, and counts of from 6,000,000 to 9,000,000 are often found. This increase is apparently of the nature of a compensatory hypertrophy. The amount of the hæmoglobin in the blood is also usually proportionately increased. The number of leucocytes is seldom abnormal.

Clubbing of the Fingers and Toes occurs in most cases of cyanosis, but not in all. It may be present at birth, or may only develop after months or years, and is sometimes found without any cyanosis. A severe degree of clubbing never takes place in childhood from acquired heart-lesions.

2. **Physical Signs.**—On inspection of the chest, visible pulsation in unusual areas is often observed, and alterations in the position and force of the apex-beat, and coarse thrills are frequently made out on palpation—especially at the base of the heart and over the right ventricle. In many cases changes in the size and contour of the heart can be demonstrated by palpation and percussion. On auscultation, alterations in the loudness of the sounds and murmurs, with unusual areas of audition and propagation, are commonly heard. The murmurs

are nearly always systolic in time, but in a very few cases they are diastolic or presystolic.

The combinations of these phenomena are usually much more significant than their individual occurrence. It is often difficult or impossible to determine the exact area of maximum intensity of these murmurs, and this difficulty is, in doubtful cases, strongly in favour of the congenital nature of the heart-lesion. The area of maximum intensity may also vary at different times in the same case. If the patient becomes anæmic, the murmurs often alter considerably in character, and their areas of audition may become greatly enlarged. When a patient with a congenital heart-lesion is dying in a state of great debility, the murmurs frequently diminish or even disappear.

3. **Indications of Circulatory Disturbance.**—Both in cases with cyanosis and in others, there is sometimes great *debility;* and a degree of *infantilism* is observed in many of the children as they grow older. *Dyspnœa* is common on exertion, though it may be absent when the child is at rest. It is chiefly seen in cases with cyanosis. Distressing spontaneous breathlessness usually accompanies attacks of paroxysmal angina.

Recurrent attacks of *heart-pain with cyanosis*[1] are, as already mentioned, not at all uncommon. They usually begin gradually, but sometimes become so severe that the child is quite stupefied and ceases for the time to notice what is going on around him. Sometimes he seems to lose consciousness altogether, and the seizure may end in a convulsion or even in death. When the patient has previously shown neither deep cyanosis nor a loud murmur, the occurrence of an attack of this kind may be the first thing to draw attention to the state of his heart.

Not a few children with congenital heart-lesions are first brought to the physician on account of recurrent attacks of *epistaxis* or for *convulsions.*

The General Diagnosis of Congenital Heart-Disease.—The lesions that may be found in these cases are not only very numerous, but they vary greatly in degree as well as in kind, so that their exact diagnosis is always difficult and indeed generally impossible. The difficulty is aggravated by the fact that it is far commoner to find several malformations present

[1] Variot et Sébilleau, *La Clinique Infantile*, 1 Mars 1904, t. ii., 137; and Sébilleau, "La Cyanose Congénitale Paroxystiques," *Thèse de Paris*, 1904.

than one only, and in some instances the occurrence of secondary endocarditis may also further obscure the diagnosis. Fortunately, the prognosis and treatment of the individual case depends very little on the exact nature of the lesion present. They have to be decided by quite different considerations.

What is of real importance in the matter of diagnosis is *first*, to settle whether the lesion is congenital or acquired, which is usually not very difficult in young children; and *secondly*, if the condition is congenital, how much it is likely to interfere with the heart in the efficient performance of its functions. This is a matter of the greatest importance for both the prognosis and treatment.

It is generally easy in early childhood to distinguish the lesions of congenital from those of acquired heart-disease. At this age acute endocarditis is rare, and when it does occur, is mostly due to pneumococci or other pyogenic organisms, and secondary to empyema or acute epiphysitis. The murmurs which are most often mistaken for those of congenital heart-disease are functional bruits of obscure origin, which are sometimes heard between the sternum and the left nipple-line, or over the base of the heart. In a few cases such murmurs have to be watched for a considerable time before one can be certain that they are not due to a congenital defect. Generally, however, there is no difficulty, for these murmurs are never accompanied by cyanosis or clubbing, or by changes in the contour of the heart, and they are rarely loud or harsh in character.

The following **axioms**, which are taken mostly from Hochsinger's interesting work,[1] will often be found helpful. They are founded on the observation of children under five years old.

1. *Loud* harsh musical murmurs with a *normal or but slightly increased area of dullness* are not met with in little children except in congenital cases. When acquired heart affections occur at this age, with loud murmurs, they invariably cause great increase in the cardiac dullness.

2. The occurrence of murmurs along with *greatly increased cardiac dullness* and *feeble apex-beat* in young children is in favour of congenital disease. The increased dullness depends

[1] Hochsinger, "Ueber Diagnostik angeborener Herzfehler bei Kindern," *Wiener Klinik*, Feb. 1891.

mainly on the right heart, while the left is but slightly altered. On the other hand, acquired heart-disease in children is accompanied by increased force of the apex-beat, because its effect falls first on the left side, while the dilatation of the right heart sets in later and does not affect the strength of the apex-beat.

3. Complete *absence of murmurs at the apex*, while they are distinctly *present in the region of the auricles and over the pulmonary orifice*, is always an important element in the differential diagnosis, and is more in favour of septal defects or congenital pulmonary stenosis than of endocarditis.

4. Abnormal weakness of the pulmonary second sound, along with a distinct systolic murmur in early childhood, can only be explained by assuming the presence of congenital pulmonary stenosis.

5. *Absence of a palpable thrill*, in spite of loud murmurs audible all over the præcordial region, occurs almost exclusively in cases of congenital septal defects, and this condition is therefore against a diagnosis of acquired heart-disease.

6. *Loud systolic murmurs* (especially those accompanied by a thrill), which have their point of maximum intensity over the upper third of the sternum; and are unaccompanied by any sign of hypertrophy of the left ventricle, are important in the diagnosis of persistence of the ductus arteriosus, and cannot be explained by the assumption of endocarditis of the aortic valves.

7. A murmur in the second left interspace a short distance from the sternum, which begins after the first sound, lasts through the short pause and second sound into the long pause, and is accompanied by a corresponding thrill, is usually caused by a patent ductus arteriosus,[1] although a murmur with these characters is by no means always present in cases of this lesion.

8. The presence of congenital defects in other parts of the body is in favour of any heart affection which is present being of congenital origin.

General Prognosis.—In examining cases of congenital heart disease in early infancy little help as to the prognosis can be got from the murmurs present, as has already been mentioned. In most cases we have to be guided entirely by the child's

[1] G. A. Gibson, "On Persistence of the Arterial Duct and its Diagnosis," *Edin. Med. Journ.*, July 1900, viii., 1.

general strength, the character of the pulse, and the presence or absence of cyanosis, and of enlargement of the heart and liver. Generally speaking, it is unfavourable in proportion to the degree of discoloration and of clubbing of the fingers present. In some serious cases, however, the cyanosis is slight or usually absent, although paroxysmal attacks of it may occur from time to time.

A large proportion of the cases of congenital heart-lesion die within the first few weeks, and probably about two-thirds of them before the end of the second year. If the baby is well grown, well nourished, and vigorous, with little or no cyanosis and no increase of the cardiac dullness, an unfavourable prognosis as to his future should not be lightly given until he has been for some time under observation.

In older children the same points have to be considered; but in most of the less severe cases the chief, and only satisfactory, way of estimating the patient's prospects of growing up and enjoying life like other children, and of judging how much or how little he should be allowed to do, is to enquire into the response of the heart to effort. To do this we have to find out what exertions he has been in the habit of making without dyspnœa or undue fatigue; and we may try also how much he can now do without discomfort.

Should the child show any tendency to bronchial catarrh, this must be taken into consideration in the prognosis, for, in these children, that condition is very apt to pass into broncho-pneumonia. For this reason also, measles and whooping-cough are very apt in them to end fatally. The tendency to the occurrence of ulcerative endocarditis has also to be remembered.

When a child with a congenital heart-lesion is found to be suffering severely from general debility, it is always important, before giving a grave prognosis, to make sure that the symptoms are due to the state of the heart and not to other causes. I have, on several occasions, seen children who had a congenital cardiac malformation and were supposed to be dying from it, but whose alarming symptoms were entirely due to other causes, such as infantile scurvy, severe rickets, or some other food disorder, and who rapidly recovered strength under appropriate dieting.

The Diagnosis and Prognosis of Particular Lesions.—Although it is not necessary here to deal at length with the

clinical manifestations of the numerous varieties of congenital heart-lesions, a word or two may be added about the symptoms and prognosis of a few of the commoner types.

Congenital Pulmonary Stenosis is probably the commonest cardiac malformation met with in general practice, for Peacock[1] asserts that it is present in more than four-fifths of the children with congenital heart affection who survive to the age of twelve years. The patients are deeply cyanosed and generally have a loud harsh pulmonary murmur which is often accompanied by a thrill. In some cases the pulmonary second sound is entirely absent.

Transposition of the Large Vessels is not very rare in young infants. In this condition the cyanosis may only be slight, but the patients are always very feeble and they usually die before the end of the first year.

Patency of the Ductus Arteriosus is one of the commoner malformations, but it is not very often found as the only lesion. When it does occur alone, the patient generally enjoys good health for many years, and only begins to show cyanosis or to suffer from other cardiac symptoms in later life, if at all. The characters of the clinical phenomena probably vary a great deal according to the size and shape of the patent duct.

Patency of the Foramen Ovale gives rise to no symptoms or physical signs unless the opening is very large. Small apertures in it are scarcely to be reckoned as abnormalities, as they do no harm and may even in some circumstances have a favourable effect on the circulation. When the opening is large, however, it may occasion considerable interference with the action of the heart. The question as to the physical signs which it may produce is a matter of great difference of opinion. One thing is certain—that its presence can only in the rarest instances be recognised during life.

Defects in the Upper Part of the Interventricular Septum are common. They are occasionally the only defect present, but generally are accompanied by other malformations. A foramen in this situation, when it is the only lesion, may give rise to neither symptoms nor signs; but in most cases there is a loud harsh murmur over the third and fourth left costal cartilages, and sometimes enlargement of the right heart. Cyanosis is

[1] T. B. Peacock, *On Malformations of the Human Heart*, 2nd ed., London, 1866.

noted in about one-half of the cases and a thrill in about one-third. As the fœtal opening in the interventricular septum normally closes early in the second week of intrauterine life, its persistence may be held to indicate a very early disturbance of the child's circulation.

Treatment.—Most children with congenital heart-lesions have to be treated as invalids all their life, and they may be made happier and more comfortable if their habits are carefully regulated so as to prevent unnecessary excitement and exertion, and all causes of chill and of the indigestion which is so apt to aggravate their symptoms. They should always rest in the middle of the day, and their slightest ailments must be carefully attended to on their first appearance. School life is generally, though not always, out of the question. When anginal attacks occur, carminatives should be given after meals, and inhalation of amyl nitrite when the pain begins. If these measures fail to relieve the distress, it is usually necessary to have recourse to opium in some form. In ordinary cases of congenital heart affection digitalis has no effect on the cyanosis and other symptoms, but should heart-failure, epistaxis, or convulsions set in, it may be very useful.

In those cases with loud congenital heart murmurs, in which there is no abnormal fatigue or discomfort on exertion, no treatment is required. These children are practically in good health, and they should certainly be allowed to run about freely and exert themselves in any reasonable way as much as they like. Anæsthetics and surgical operations are no more dangerous for them than for other children.

Acquired Organic Heart-Disease.

Endocarditis may occur at any age; but it is rare in children under three. It may affect any of the valves, but in the great majority of cases it is the mitral which suffers. Aortic stenosis is especially rare in childhood, and cases with a basal systolic murmur, which have been diagnosed as due to this condition, not very rarely prove to be due to some less serious cause. It is characteristic of childhood that the myocardium and pericardium are often and severely affected.

Symptoms.—The physical signs of endocarditis in children do not differ essentially from those in later life, but hypertrophy

and dilatation occur more readily and more rapidly. The general symptoms are usually very indefinite. There may be a slight rise of temperature along with pallor, a short dry cough, breathlessness on exertion, palpitation, and emaciation. Even in severe cases of valvular disease it is rare in childhood to meet with the great œdema of the limbs, enlargement of the liver and spleen, dyspnœa, and cyanosis which are so commonly seen in the adult in advanced cardiac disease.

Causes.—Heart-disease in children may arise from many causes, some of which are obscure in origin. The great majority of cases, however, are due to rheumatism, and the main thing we want to know about the cause of any case is whether it is or is not rheumatic. This question is an important one because, if the lesion is rheumatic, it throws light on the child's tendency to disease and indicates much with regard to his present and future treatment. The absolute diagnosis of rheumatism must depend on the presence of one or more other manifestations of that disease in the patient, or on the past history of their having been present. If characteristic acute arthritis of one or more joints exists, that is usually held to be sufficient to settle the question; and the presence of erythema circinatum or of choreic movements has practically the same significance. The most satisfactory proof, however, of the presence of rheumatism is the finding of rheumatic nodules (Chapter XXXV.).

Treatment.—The treatment of any recent form of acquired heart-disease in childhood differs in no important respect from that in adults. The first and main point, the importance of which it would be difficult to exaggerate, is that the child be kept lying, and all exertion avoided both during, and for weeks or months after, the illness. The period during which complete rest is necessary varies, of course, in different cases. The indications that the amount of rest may be lessened are slowing of the pulse, the appearance of the juvenile form of irregularity, and decrease in the size of the heart.

The next point is that if the case is, or may be, rheumatic, it should be treated actively by anti-rheumatic measures, including salicylates in large doses. Digitalis and allied remedies are valuable in suitable cases, but they must not be given indiscriminately, merely because the heart is affected, but be-

cause there are signs of failing circulation. G. A. Sutherland[1] has recently shown that great advantage frequently follows the free administration of digitalin in cases of rapid pulse in rheumatic children as well as in auricular fibrillation. Anti-rheumatic treatment should be given at the same time. In severe cases of chronic valvular disease in children, with heart-failure beginning, a course of grey powder may greatly assist the action of digitalis, just as blue pills often do in the case of adult patients.[2] In valvular heart-disease due to rheumatism, it is important to be always on the outlook for possibly rheumatic symptoms such as joint-pains and sore throats, and to abort them by early treatment. It is also desirable that any source of recurrent infection such as an unhealthy naso-pharynx or tonsils should be set right.

Pericarditis.—In children under three years, pericarditis is generally met with as a complication of empyema or pneumonia. Such cases of pneumococcal pericarditis are apt to be overlooked, because there are often no ascertainable subjective symptoms and also no friction. They are probably always fatal.

In older children, the condition occurs most frequently as a manifestation of rheumatism. When this is so, it generally—although not always—runs a rather subacute course with little or no fluid effusion. If the case is at all severe, the myocardium is usually more or less extensively implicated, and dilatation of the heart occurs. Pericarditis is generally met with in children who have already suffered from other rheumatic manifestations.

Occasionally severe pericarditis sets in suddenly in older children, apart from rheumatism, as a primary disease. In these cases the friction is very loud, but there are scarcely any other distinctive symptoms—merely a slight præcordial uneasiness with a rise of temperature. Complete recovery usually takes place, if the case is recognised early and the patient kept in bed.

Pericarditis is not an uncommon occurrence in the course of scarlet fever and some other infective conditions; and it is occasionally met with in tuberculosis.

Treatment.—In slight cases of rheumatic pericarditis nothing beyond complete rest and general anti-rheumatic treatment is called for. When the case is at all severe, how-

[1] *Quart. Journ. Med.*, April 1919, xii., No. 47, 183.

[2] Wm. Murray, *Rough Notes on Remedies*, London, 3rd ed., 1899, 49.

ever, local measures are important.[1] The main danger in such cases arises from the tendency of the right auricle to become over-distended. It must therefore be closely watched by percussion in the fourth right intercostal space, and if it is dilating, leeches (four to six) should be at once applied over the heart or venesection done. An ice bag should then be applied over the præcordial area, the patient's lower limbs having first been thoroughly warmed by hot water bottles. The child should lie on his back, and the ice bag should be placed over the heart with nothing between it and the skin of the præcordia. If there is much local hyperæsthesia, the ice bag should, to begin with, be suspended over the patient so that it just touches his chest. It should be refilled every hour and a half, and the hot bottles every three hours. Children usually like this mode of treatment and wish it reapplied when it is discontinued.

Along with the local treatment, salicylate and bicarbonate of soda should, in most cases, be given internally.

Paracentesis pericardii is very rarely required.

Aortic Aneurism.

Thoracic aneurisms are very rare in childhood; but a number of cases have been placed on record.[2] The majority of these have been due to atheromatous changes in the vessel wall which have generally been attributable to congenital syphilis. A few, including that of Bronson and Sutherland, have occurred as the result of co-arctation of the aorta. In exceptional instances, an aneurism may arise from traumatism, from septic infection, or from embolism; and false aneurisms may occur as the result of erosion from without.

Neurotic Heart Affection.

Severe cases of neurotic disturbance of the heart's action are occasionally met with in children of school age, apart from any organic lesion. In these, there is a constant tendency to great rapidity of the heart's action with palpitation, on

[1] Lees, *Treatment of Some Acute Visceral Inflammations*, London, 1904, 32.

[2] E. Bronson and G. A. Sutherland, "Ruptured Aneurisms in Childhood," *Brit. Journ. Dis. Child.*, 1918, xv., 241.

the least emotional excitement. Functional murmurs, with some dilatation, are often also present. Muscular exertion apart from excitement causes no abnormal quickening of the pulse, though the least emotional excitement does so at once. *During sleep the pulse-rate is normal.*

These cases are very troublesome. They last for years, and interfere greatly with school-work and with open-air games of all kinds.

The *treatment* is that of the general nervous state. It includes the avoidance of all causes of worry or excitement of any kind, much rest and sleep, and a routine of quiet occupations in familiar surroundings. The patient should be much in the open air. Digitalis is of no value; but the prolonged administration of bromides is distinctly beneficial.

In cases that are carefully looked after, the *prognosis* as to ultimate recovery is good. After the period of puberty, if not before, the nervous irritability gradually subsides, and in time the heart symptoms entirely disappear.

Raynaud's Disease.

This name is given to a group of cases in which there occur, from time to time, paroxysmal attacks of extreme numbness and chilliness of the extremities, with a more or less symmetrical distribution. According to Raynaud, the local condition depends on an undue irritability of the vasomotor centre or centres, owing to which ordinary causes of stimulation, such as slight cold, produce exaggerated effects and result in prolonged paroxysmal contraction of the peripheral arterioles. A large proportion of the patients are the subjects of congenital syphilis.

Symptoms.—Raynaud describes the effects of the arterial spasm as occurring in three degrees of severity—local syncope, local asphyxia, and local symmetrical gangrene.

Local Syncope.—In this, one or more digits on each hand or foot becomes white and "dead." The condition varies greatly in severity, being sometimes merely a slight exaggeration of the chilliness of the extremities which is natural to many children. There may be little or no pain, merely a degree of discomfort with some analgesia and blunting of the tactile sense. After a few minutes—or a

few hours—the attack passes off with a sensation of burning heat, and the affected part soon resumes its usual colour. The patient's general health seems unaffected. The attacks generally occur in cold weather, and there has often been some slight exposure to cold air or cold water; they also often set in after a full meal.

Local Asphyxia. — In this the affected extremities, or digits, assume a deep dusky purple colour and become painful and tender. Generally the hands and feet are affected, less commonly the ears, and rarely the nose. Local asphyxia may

FIG. 143.—Gangrene of Toes from Raynaud's Disease. Boy of 7 years.

succeed to local syncope, or it may occur without any previous pallor of the parts being noticed.

Local Symmetrical Gangrene.—This is the terminal stage of the two other degrees; fortunately, it is not often reached. Sometimes the extremities of the digits become gradually black and mummified. In other cases the necrotic process begins with the formation of bullæ on the surface of the cyanosed parts, as happened in the case shown in Fig. 143.

In a few cases of Raynaud's disease we meet with hæmoglobinuria at the time of the attacks. Mental torpor may be present; and epileptic fits occasionally occur. Peripheral neuritis has been found in the affected limbs.

Diagnosis.—Severe cases of chilblain are apt to be mistaken for this disease. Chilblains differ from Raynaud's disease, however, in lacking the paroxysmal character, in not all being at the extreme ends of the digits, and in generally showing some signs of inflammatory exudation.

Treatment.—The most important part of the treatment is the prophylaxis, which consists in attending to the digestion and nutrition, and in guarding against any unnecessary exposure. The prolonged use of cod-liver oil and arsenic seems beneficial in chronic cases.

When the attacks occur, the most successful means of relieving the symptoms, especially in acute cases, consist in the use of the galvanic current. The best mode of applying it is described as follows by Sir Thomas Barlow. "Immerse the extremity of the limb which is the subject of local asphyxia in a large basin containing salt and tepid water; one pole of a constant current battery is placed in contact with the upper part of the limb, above the level of the water, and the other pole in the basin, thus converting the salt and water into an electrode. As many elements as the patient can comfortably bear should be employed; and the current should be made and broken at frequent intervals, so as to get repeated moderate contractions of the limb. The patient should also be instructed to make voluntary movements of the digits while the galvanism is applied."[1] When the two limbs are equally affected, in a typical paroxysmal case, and the electric treatment is applied only to one of them, the limb thus treated is found to recover more rapidly than the other which is merely kept warm. Massage and Swedish movements should also be used. If the pain is severe, or if gangrene threatens, opium is indicated.

[1] Barlow, art. on "Raynaud's Disease," *Allbutt and Rolleston's System of Medicine*, vol. vii., 1910, 120.

CHAPTER XXV

ON THE EXAMINATION OF THE LUNGS AND RESPIRATORY PASSAGES

Inspection.

Form of the Chest.—The infant's chest differs considerably in shape from the adult's in being more cylindrical, and its section is consequently more nearly circular in outline. Its form is also readily altered by any disease which either lessens the resiliency of the chest-wall, or interferes in some way with the free play of the lungs. The commonest chest deformity met with in young children is that associated with rickets; but we also often find other types due to infantile scurvy, asthma, and adenoids, various degrees of pigeon-breast, and occasionally unilateral retraction or distension due to disease of the lungs or pleura, or to curvature of the spine.

The **rickety thorax** is characterised by beading of the ribs and by its peculiar shape (Figs. 60 to 63). The *beading* or rosary is situated at the junction of the cartilaginous and osseous portions of the ribs, and in fat children is more easily felt than seen. The swellings usually project on the pleural side of the chest-wall a good deal more than on the surface. The first and second ribs are those least affected, while the largest beads are found on the fifth and sixth—that is, on those with the widest range of movement.

In some severe cases of rickets we find a few *posterior beads* on one or other side of the back of the chest (Fig. 66, p. 224). These swellings are asymmetrical in position, and their pathology is quite different from that of the ordinary rickety rosary. They are composed of callus which has formed round fractures of the ribs, caused usually by lateral compression of the chest in lifting the child. Similar lesions of the clavicles are

not uncommon and are due to sudden lifting of the patient by his upper arms.

As the chest-wall, outside the line of the beading, is abnormally soft and yielding, it becomes indrawn in this position, causing parallel grooves in front of and behind the rosary. In rickety chests there is usually also another horizontal groove running across the front at the level of the upper end of the xiphi-sternum (*Harrison's sulcus*). In extreme degrees of rickety deformity the chest assumes a peculiar shape (Figs. 60 to 63), the cyrtometer tracing of which somewhat resembles the outline of a violin (Fig. 144).

The thoracic deformity which occurs in some cases of **infantile scurvy** has been already described (p. 209). It is

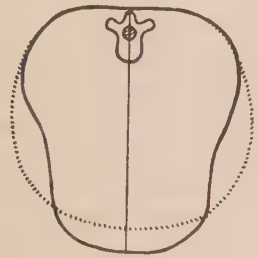


FIG. 144.—Rickety Chest. Dotted line indicates shape of normal chest at same age (Gee).

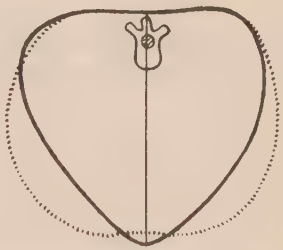


FIG. 145.—Pigeon-Breast. Child of 7 years. Dotted line indicates natural shape at same age (Gee).

characterised by a general depression of that part of the chest-wall which is formed by the sternum and costal cartilages, owing to bending or fractures of the ends of the ribs having occurred near the costo-chondroid junctions. These give rise to a row of projections which simulate the rickety rosary.

In scurvy we also sometimes find swellings on one or more ribs due to localised subperiosteal hæmorrhages.

In **pigeon-breast** the abnormal forward projection is more pointed than that in rickets, so that its horizontal outline is almost triangular (Fig. 145). This deformity may be said to present in a permanent form the shape which the normal child's chest assumes, temporarily, during forcible inspiration through a narrowed glottis (as in croup or whooping-cough), or when, from some other cause, the lungs do not expand properly. It develops gradually as the result of frequently repeated and long-continued temporary changes of form. In infancy, it is

seen in congenital atelectasis, in bronchitis with collapse, and in congenital laryngeal stridor. One may watch its development, in a previously well-formed chest, during a severe attack of whooping-cough. When pigeon-breast is present in older children, there is generally a history of recurrent bronchitis.

The **Adenoid Chest.**—Practically all cases of adenoids show some chest deformity—the degree varying with the extent to which the growths have interfered with the free entrance of air into the bases of the lungs and restricted the movement of the diaphragm. In severe cases in young children with soft chest-walls, there may be regular pigeon-breast. In older children, however, the deformity is less extreme. It consists in a transverse constriction of the chest about the level of the lower end of the sternum, with a more or less deep vertical mesial groove over the ensiform cartilage and above it.

In some weakly children we meet with a form of chest deformity which is in striking contrast to that of pigeon-breast. In this the thorax is broadened from side to side and much flattened antero-posteriorly. The lower end of the sternum is depressed, so as to lie at the bottom of a deep hollow, and its posterior surface is approximated to the spinal column. The cyrtometer tracing has a somewhat kidney-shaped outline.

The characteristic barrel-shaped chest of asthma often develops in young children; and asymmetrical deformities of the thorax are frequently found as the result of old pleurisy or atelectasis. Many children show a combination of different kinds of thoracic deformity.

All varieties of malformed chests in children have a strong tendency to improve as the child gains strength and the body grows and develops—provided their original causes have ceased to act. This disposition towards recovery can be increased greatly by regular breathing exercises, musical drill, and various forms of gymnastic movements of the upper limbs and trunk.

In inspecting the chest, marked enlargement of the superficial veins is worthy of note. This is found as a sign of enlarged bronchial glands, as well as in cases of intrathoracic tumour.

Movements of the Chest.—In infancy and early childhood, the chest moves little in ordinary breathing compared with the abdomen, and this abdominal type of respiration usually

continues till about the seventh year. A notably thoracic type of breathing in young children is characteristic of acid-intoxication. The same thing may also be observed occasionally to a less extent, for some time after a severe and prolonged attack of whooping-cough. In watching the respiratory movements we must notice whether the movement is equal on the two sides, and if there is much indrawing of the episternal notch or of the epigastrium on inspiration. Such indrawing means that sufficient air is not entering the chest. Its significance varies according to the circumstances under which we meet with it. Thus, in extreme rickets, its occurrence may be largely explained by the abnormally collapsable character of the chest-wall, and indicate no immediate risk. In a fairly normal chest, however, the same amount of indrawing may be a serious sign. In broncho-pneumonia the degree of the retraction helps us to gauge the extent to which the lungs are affected; while in croup, its presence in any marked degree is an indication for immediate surgical assistance.

In watching the respiration it is well to note if the normal bulging of the upper part of the abdomen occurs with each breath. If it is replaced by a sinking in of the region with each inspiration, it signifies deficient action of the diaphragm.

The movements of the alæ nasi should also be observed. In dyspnœa from serious organic disease, they are often greatly exaggerated; and if, in a case of noisy or rapid breathing, there is no increased movement of the alæ, it is a reassuring sign. We must, of course, remember, in judging of the movements, that the development of the nostrils and their muscles varies much in different children.

Palpation.

One of the first things to be done in examining the *lungs* is to determine the position of the *heart's apex-beat*, and whether there is any distinct epigastric pulsation. If the apex is displaced to one or other side, as oftens happens in pleurisy with effusion, in collapse, and in fibroid conditions of the lung, this throws a useful light on the diagnosis and may shorten the subsequent examination. In cases of acute lung disease, the state of the heart as to strength, or weakness, or dilatation of its right side, is generally far more important from the point of view of the prognosis and treatment than is the extent of lung involved.

Vocal fremitus is sometimes difficult to obtain in children, owing to the quality of the child's voice and his unwillingness to speak out; but it may be easily obtained when he is crying. Rhonchal fremitus is observed in many cases of bronchitis.

Auscultation.

When little children are frightened, they often hold their breath when we try to auscultate them, and will not breathe freely. This may delay our examination, but, at any rate, it shows that there is no serious lung-disease present. Screaming is not nearly so troublesome an interference with auscultation as one might expect, for it makes the child take long deep breaths, and thus accentuates any accompaniments there may be. Similarly, the auscultation of the heart may often be carried out quite easily when the child is crying vigorously, because, in the pauses between the cries, there is time for one or two cardiac revolutions to take place. Whimpering and suppressed sobbing interfere far more with our examination.

The child's chest has great powers of conduction, so that the heart-sounds are heard at the back comparatively well without any consolidation of the lungs being present, and crepitations produced on the one side may be heard clearly on the other.

The *breath-sounds* in young babies are naturally very weak, owing to the feeble shallow nature of the breathing. They gain in strength as the child grows, and about the age of six months they have acquired the peculiar harsh character known as *puerile*. In older children *abnormal weakness* of the sounds is an important sign. We meet with it in the early stages of pneumonia, in pleuritic effusion, in collapse of the lung, and in pneumothorax. It is also sometimes met with in cases with great thoracic deformity, and in these is apparently due to local emphysema or collapse. If the breath-sounds differ in loudness on the two sides of the chest, the side with the weaker breathing is almost always the abnormal one. Areas of weak breathing, which pass off rapidly, are sometimes found in children from temporary collapse of a portion of lung due to blocking of a bronchus with mucus.

Tubular breathing is more often met with in pleurisy with effusion in children than in adults, and its presence sometimes leads to a mistaken diagnosis of consolidation. When a large

area of solid lung is present on one side, the tubular breathing to which it gives rise may sometimes be heard so plainly over parts of the normal lung as to be misleading. In pleurisy in young babies, we may fail altogether to hear *friction* sounds; and we are better guided to a diagnosis by the catch in the breath and the evident uneasiness which follows when the child inspires freely or attempts to cry.

A peculiar alteration in the rhythm of the breathing is often noticed, and is perplexing to beginners. In ordinary breathing, we have inspiration followed by a shorter expiration, then a pause; then inspiration again, and so on. In the peculiar breathing referred to, there is first a long loud expiration, the noise of which is sometimes accompanied by a sort of grunt. This is followed immediately by a short inspiration, then there is a pause; then expiration begins again, and so on. This *breathing with expiratory rhythm* is heard in its most marked degree in commencing pneumonia. A certain amount of it, however, is common in little children with perfectly healthy lungs—when they are apprehensive or frightened.

Vocal resonance frequently cannot be obtained in the usual way by getting the child to speak, but the cough or cry is generally quite sufficient to elicit it.

Percussion.

In children percussion of the lungs should always be light; for if strong it is apt to mislead by bringing out dullness or resonance, as the case may be, from underlying organs. It is essential *to see that the patient is sitting straight*, because even a slight twist of the spine may give rise to distinct differences in the note on the two sides of the chest. Variations in the curve of the chest-wall have a similar effect; so that, in a deformed chest, local impairment of the percussion-note may be found which is not due to any change in the lung, but merely to a sharper curve of the ribs.

A slight area of dullness may be due to a local patch of collapsed lung, or to the result of an old pleurisy. In any case, a slight impairment apart from any other sign or symptom is not to be regarded very seriously in children. On the other hand, even when fluid is present in the pleura, the dullness is often less absolute than might have been expected; and

patches of consolidated lung may cause very little dullness, owing to their being surrounded by emphysema. As a result of the yielding nature of the chest-wall, a well-marked *cracked-pot sound* is often obtained on percussion in little children with perfectly healthy lungs—especially when they are crying. When acute pleurisy is present, there may be considerable tenderness on percussion.

Sputum.

Natural expectoration does not usually begin till between five and seven years old. Before this, unless they have been taught otherwise, children always swallow the sputum. If a specimen is required from a baby, it may be obtained from the stomach by passing an œsophageal tube. Sufficient sputum may usually, however, be procured by passing the tongue depressor back so as to touch the epiglottis or pharynx and start a cough. Any expectoration that is brought up is thrown on the pharyngeal wall and may be collected on a little swab of wool before the child has time to swallow it.[1] Another, even simpler, way consists in introducing the index finger so that it lies over the glottis. The child will usually cough, and a little sputum will then adhere to the point of the finger.[2]

Hæmoptysis is rarely an important or serious symptom in early life, although a little blood-stained expectoration is often seen in cases of pertussis or other violent forms of cough, and sometimes also in slighter coughs if the throat or gums are ulcerated. Hæmoptysis does not occur in phthisis in children as an early symptom, as it often does in adults. It is, however, not an uncommon terminal occurrence in pulmonary tuberculosis, and especially in gangrene of the lung.

Fetid sputum is characteristic of pulmonary gangrene; and it is also found in ulcerative stomatitis. In the bronchiectasis of young children the sputum has often no offensive odour.

The Larynx.[3]

The upper aperture of the larynx at birth (Fig. 146) differs little from that in older children (Fig. 149). Its structures,

[1] Variot, *Bull. de la Soc. de Pédiatrie de Paris*, 20th Jan. 1903, 13.
[2] Netter, *ibid.*, 14.
[3] Thomson and Turner, *Brit. Med. Journ.*, 1st Dec. 1900, ii., 1561.

however, are much softer and more collapsable, so that they are frequently sucked together by the irregular jerky inspirations of the young infant. This soon results in a change of form to the infantile type (Fig. 147), which is found in a varying degree in all young infants who have breathed. In the infantile larynx, the epiglottis is distinctly gutter-shaped on its posterior aspect, while the soft and yielding ary-epiglottic ligaments come nearer together so as to narrow the upper aperture. The narrowness of the orifice, and the softness of its walls, account for the readiness with which crowing occurs on slight occasion in young babies.

As the child grows older, the parts become more rigid, and, in most cases, they gradually assume the adult type (Figs. 148

FIG. 146.—At birth.

FIG. 147.—At 3 months.

FIG. 148.—At 7 years.

FIG. 149.—At 9 years.

UPPER APERTURE OF THE LARYNX AT DIFFERENT AGES.

and 149). Occasionally, however, the infantile type persists in some degree even into adult life.

Laryngoscopy.—Even expert laryngologists find it difficult to see the vocal cords in infants of a few months; and it may be quite impossible to do so in the ordinary way, owing to the extreme readiness with which the contents of the œsophagus and stomach are brought up on any attempt to introduce a laryngeal mirror; consequently, a view of the epiglottis is all that can be obtained. In new-born babies this tendency is not quite so strong as in those a little older, so that in them the examination is rather easier. Direct laryngoscopy, by Killian's method, may be successful in skilled hands when the ordinary method fails. In young infants, however, it is a very unpleasant proceeding and if the child is feeble, by no means devoid of danger.

When an ordinary laryngeal examination is necessary in

an older child who is very nervous, it may sometimes be rendered easier if a little chloroform is given—just enough to make the child drowsy.

The Breathing.

It is characteristic of the respiration in young infants that it is irregular in rhythm and force, as if the co-ordination of its movements were not yet fully under control; and relatively sudden inspiratory efforts are frequently repeated. When excited, the baby is apt to crow, although he does not do so at other times. A similar, but louder and more persistent crowing, which exactly resembles that in infantile stridor, is frequently heard in young infants while they are coming out of chloroform narcosis; and loud crowing is also a common accompaniment of operations on the prepuce and anus, owing to the sudden forcible inspiration which is caused by stimulation of the nerves of these parts. Along with all sorts of crowing, there is always indrawing of the lower chest-wall proportionate to the loudness of the sound.

Rate and Rhythm of the Respiration.—In young infants the rate of the breathing varies so much that it is sometimes difficult to estimate it accurately. It is best counted during sleep, and we should take the average of several minutes. In new-born babies the rate varies from 32 to 50 respirations in the minute, and during the first year from 25 to 35. During the second, third, and fourth years, it is about 25 in the minute. The respiration-rate, like that of the pulse, varies, not only with the body-temperature, but also with the mental state. Very irregular breathing is characteristic of cerebral disease.

Rapid Breathing.—In infants of a month or two old we often find extremely rapid respiration—perhaps 100 to 120 respirations in the minute—without any respiratory distress (*polypnœa*). This may be seen, for example, in pyrexia with acid urine, and its presence does not indicate any respiratory complication. Rapid and deep breathing is also characteristic of food intoxication.

An increased rate of breathing, if accompanied by dyspnœa, usually indicates respiratory disease, and may be helpful in the diagnosis of early cases. There are various fallacies, however, to be guarded against. Thus, in cases of cerebral disease, the

respiration may appear too rapid because the pulse is abnormally slow. Again, an increased rate of breathing may occur without any lung disease in children with deformed (*e.g.*, rickety) chests, or with great abdominal distension, and also in acute peritonitis. Some infants also, as Henoch pointed out, have a respiration-rate of 60 to 90 to the minute without any local cause, during the state of nervous irritability which accompanies teething; in these there is no respiratory distress. Rapid breathing is also seen in lithæmia, in some forms of asthma, during and after whooping-cough even when the lungs are not seriously affected, and in measles when the rash is coming out. It is also a common symptom in early cases of acute cerebro-spinal meningitis and coli-pyelitis.

Pulse-Respiration Ratio.—The pulse-respiration ratio in health should be 1 to $3\frac{1}{2}$ or 4, and any great disturbance of this proportion is of clinical importance.

Sound of the Breathing (*Extra Auscultation*).—A great deal can often be made out about the state of a child's respiratory passages by listening to his breathing, his cry, and his cough.

Snuffling breathing indicates obstruction of the nasal passages. This often arises in young infants from ordinary catarrh; but when it goes on for a long time or occurs apart from other catarrhal symptoms, it always suggests the possible presence of syphilis. "Snuffles" is one of the most constant symptoms of congenital syphilis, and usually appears before the rash (p. 745). Sometimes it is very slight, and it may be inaudible unless the child's mouth is closed. As mentioned elsewhere (Appendix C), snuffling is one of the common symptoms in anaphylaxis.

Snoring during sleep, with noisy breathing while awake, and a nasal tone of voice, commonly indicates the presence of swollen tonsils or adenoids, but may also be due to paralysis of the palate. *Noisy breathing* with dyspnœa chiefly during inspiration, and a cry which is nasal but not generally hoarse, is characteristic of retro-pharyngeal abscess, and calls for digital examination of the pharynx.

Deep *sighing* occasionally occurs in little children, without meaning much, but it is an important symptom in the prodromal stage of tuberculous meningitis. Sighing breathing is also characteristic of over-distension of the right side of the heart. Reference may also be made here again to the

"grunting" noise which accompanies the dyspnœa of pneumonia, and to the somewhat similar noisy panting breathing, with expiratory rhythm, sometimes noticed in cases of masturbation in little children. Noisy gasping respiration is found in certain toxæmic conditions (such as diphtheria and influenza) before death, and indicates the formation of an ante-mortem clot in the heart.

Laryngeal or stridulous breathing is due to either organic or spasmodic narrowing of the windpipe, and is met with in true and false croup and in other forms of laryngeal obstruction. In young babies it is frequently a sign of congenital laryngeal stridor (infantile respiratory spasm), but it may also be caused by laryngeal papilloma, adenoids, and tracheal obstruction from enlarged glands. It is common during the onset of measles.

Bronchial wheezing is often heard in bronchitis of the larger tubes as well as in asthma.

Dyspnœa.

That a child's breathing should be rapid or noisy does not always matter very much; but whenever it ceases to be easy and effortless, and becomes consciously embarrassed, we may be sure that there is something seriously wrong. Different forms of dyspnœa have different characters, according to the various conditions under which they occur. Thus, in some, the shortness of breath is spontaneous, while, in others, it only follows exertion; the difficulty may be inspiratory as in early croup, or expiratory as in asthma; it may be accompanied by acceleration of the respiration as in pneumonia; or by its slowing as in laryngeal obstruction; in many instances cyanosis is present, in others, although the dyspnœa is severe, cyanosis is absent. Cases of abnormal dyspnœa may also be divided into those in which the symptoms are intermittent, and those in which they are continuous.

Causation. — *Intermittent Dyspnœa* is met with in such conditions as (1) stridulous laryngitis and laryngismus, (2) in asthma, (3) in cases of varying pressure on the trachea and bronchi by enlarged bronchial glands, (4) when there is a moving foreign body in the larynx. (5) Finally, painful, rapid, and difficult breathing, setting in acutely at intervals, in a young baby along with deficient entry of air into the bases of

the lungs and no other physical signs, is very characteristic of commencing whooping-cough. Its real nature is apt to be overlooked because it is often unaccompanied by anything resembling a whoop.

Continuous Dyspnœa is met with under very different conditions.

(1) It may be caused by any *recent narrowing* of the lumen of the upper air-passages, such as acute swelling of the mucous membrane of the nose or naso-pharynx, croup, or a fixed foreign body in the wind-pipe—an intubation-tube may act in this way to some extent. It may also arise from the pressure of a post-pharyngeal abscess or that of enlarged bronchial glands.

(2) *Obstruction of the pulmonary circulation* is another cause of embarrassed breathing. It occurs in severe valvular heart-disease, and in pericardial effusion, and is a striking symptom in thrombosis of the pulmonary vessels.

(3) Another cause of embarrassed breathing is *pressure on the lungs from without.* Extreme flatulent distension of the abdomen may give rise to it, and it may follow pneumothorax and large pleural effusions; though, if these come on slowly, the dyspnœa which they produce may only occur on exertion.

(4) *Acute collapse of the lung*, such as may occur in progressive muscular atrophy, produces severe dyspnœa; and a lesser degree results from the partial collapse of the bases which follows paralysis of the diaphragm.

(5) *Acute respiratory disease* is a very common cause of difficult breathing. We see it, for example, in severe bronchitis and broncho-pneumonia, in emphysema, and in croupous pneumonia. It is less marked in phthisis, because the limitation of the air-space takes place so gradually.

(6) *In Bright's disease with heart-failure*, dyspnœa is also a frequent symptom.

(7) An interesting and important form of distressed breathing is the *hyperpnœa* or "air-hunger" seen in acid-intoxication. In this the respiration is deep and laboured although there is no great acceleration, no cyanosis, and none of the other signs of dyspnœa. The breathing is also peculiar in having a strikingly thoracic type, very unlike that usually seen in childhood. This type of breathing is sometimes very useful in drawing attention to the unexpected presence of

diabetes, salicylate poisoning, or some other kind of acid-intoxication. Its significance is dealt with elsewhere (Chapter XXIII.).

(8) In all forms of *anæmia* dyspnœa on exertion is apt to occur.

The Cry.

Much may be learned from listening to a child's cry. From its loudness we can gauge his strength to a certain extent, and, if he cries vigorously and long without getting out of breath, we may also be almost sure that he has no serious acute disease of his lungs or bronchi. If a child with a large area of dullness cries loudly, this is in favour of his having a pleural effusion rather than pulmonary disease. Occasionally, however, children with acute pneumonia can make a good deal of noise.

The Cough.

Coughs vary greatly in character and significance. While the presence of a cough naturally draws attention to the chest, it often proves to be due to some morbid condition elsewhere (in ear, brain, heart, or stomach); and, when from the respiratory tract, it is as often a sign of irritation in the larynx or trachea, or about the pharynx and its neighbourhood (tonsils, uvula, or adenoids) as of disease lower down.

The character of the cough is sometimes useful in indicating its source. It is loud and clanging at the beginning of an attack of croup, and husky and stridulous at a later stage. In bronchitis, it is often deep and harsh. In pneumonia with accompanying pleurisy, it is suppressed and painful. If a child coughs loudly without wincing, we may be sure that he has no acute pleurisy. A very annoying and persistent cough sometimes occurs when a pleural effusion is beginning in a case of chronic lung-disease. Measles, in its early stage, is a common cause of constant uncontrollable coughing. When a child suffers from a loud noisy cough on lying down at night and also when he wakes in the morning, although he is not much troubled with it during the day, he probably has a catarrhal condition of his throat, with or without dyspepsia.

Often the cough has a distinctly paroxysmal character. This is most marked in whooping-cough, but is also frequently

present in some degree in influenza and in severe bronchitis. A similar cough occurs in some cases of empyema, of enlarged bronchial glands, and of adenoids. A cough, worst at night, occurring in paroxysms and ending in vomiting, almost certainly indicates whooping-cough; and, if there is a noticeable puffiness about the eyelids, or an ulcer under the tongue, the diagnosis is strongly confirmed. When a severe suffocative cough occurs in a very young baby, it is always well to think of whooping-cough as possible, even although there is no distinct whoop present.

Treatment of Cough.—The proper treatment for a cough is, of course, that of the morbid condition which is causing it; but, where the cause cannot be ascertained, we must treat the cough as a symptom. For this, we may use such internal remedies as heroin, antipyrine, aspirin, or butyl-chloral. Sometimes considerable relief is afforded by a large linseed and mustard poultice applied round the chest, or a small mustard plaster over the trachea or at the root of the neck. A hot drink and the use of a steam-kettle are also to be recommended. In cases where, as in whooping-cough, the cough is very violent the support of an abdominal belt sometimes gives great relief.

Sneezing.

Sneezing is, of course, a common symptom in ordinary catarrhs, in some forms of influenza, and during the invasion of measles. Severe and persistent sneezing during the summer months in children over five years may indicate hay-fever; and fits of sneezing are often noticed in children with ordinary asthma, and in those who have idiosyncrasies for certain foods (see Appendix C).

Hiccough.

As hiccough is due to spasmodic action of the respiratory muscles it may be dealt with here, although is is chiefly connected with the digestive organs. In children, as in adults, it occurs sometimes in the last stage of serious diseases of the alimentary system, such as appendicitis and peritonitis; and also in some nervous conditions. Generally, however, we meet with it as a normal phenomenon in healthy infants.

According to Thévenet,[1] it is especially frequent in breast-fed babies during the first three months of life; becomes less common as they grow older, and is rather rare by the end of the first year. It is less often seen in bottle-fed infants and occurs later in them. It usually comes on after a feed, and, when it does so, it may be regarded as the sign of a satisfied stomach comfortably digesting a copious meal; the administration of more food checks it. If the digestion is disturbed, the hiccough ceases and only returns when the derangement passes off. It does not occur when the stomach is empty. Hiccough, in babies, often follows regurgitation and sometimes comes after vomiting; but its recurrence is generally a reassuring sign and indicates that the last meal taken is going to be retained.

[1] *Lyon méd.*, 27th Aug. 1905, cv., 333.

CHAPTER XXVI

ON SOME RESPIRATORY DISEASES IN CHILDREN

Croupous Pneumonia.

CROUPOUS pneumonia occurs at all ages, but is commoner after the second year than in young babies. In young children it often begins with bronchitis. Generally it is a primary disease, and is probably always accompanied by some degree of pleurisy.

Symptoms.—The child takes ill suddenly, and the earliest manifestations of the disease are usually not respiratory symptoms; they may be vomiting or diarrhœa; headache is also common and in some cases convulsions occur; rigors are rarely met with, and only in older children. From the beginning, the child is generally prostrated. Cough is not usually a prominent symptom; and, when present, the child tries to suppress it because of the pain it causes. The sputum rarely gives any assistance, and is difficult to obtain. Herpes round the mouth and a vivid flush on one or both cheeks are commonly seen. Sometimes there is distinctly localised pain on one or other side, and when present this is often helpful in localising the site of the pneumonia. Pain from the diaphragmatic surface of the lung and pleura may be referred to the shoulder or above the clavicle in front; and, when the disease is elsewhere in the lower lobes, to the abdominal wall. Pneumonia of the right lower lobe often gives rise to pain not unlike that from inflammation of a high appendix. Occasionally, pain in the right side of the abdomen is due to a slight degree of pneumococcal peritonitis (p. 276).

The breathing is characteristic in various ways.[1] Its rate

[1] For an account of pneumonic breathing and an interesting discussion of its causation, see paper by G. A. Sutherland in *Clinical Journal*, 25th Oct. 1905, xxvii., 26.

may not be increased when the temperature first rises; but it is usually markedly accelerated before any physical signs develop. The respirations are generally 50 to 60 or more to the minute, even if only a small portion of the lung is affected; they are shallow and sometimes comparatively easy. The breathing is chiefly abdominal, while in broncho-pneumonia and bronchitis the thoracic type generally predominates. Another characteristic peculiarity of the breathing is its expiratory rhythm, which is often accompanied by noisy grunting expiration. The pulse-respiration ratio is always altered.

The temperature-curve in children over three years is much as in adults, showing a sudden rise, a continued type, and a complete crisis. The crisis generally occurs between the fifth and ninth days; but it may set in as early as the second or third, and is often deferred to the tenth or twelfth day—especially when the disease spreads and fresh areas of the lung, or the other lung, are affected. In young children (from eight months to three years) marked remissions are often seen toward the end of the fever; but all varieties of ending may occur, from the usual typical crisis to a regular lysis. Should the temperature keep up, or if it rises again soon after it has fallen, empyema may be suspected, if no otitis media is present.

The frequency and severity of cerebral symptoms in pneumonia in children, especially when the apex is affected, s a fact of practical importance. When such symptoms are severe and the chest-signs are delayed, there is sometimes a danger of the case being mistaken for one of meningitis. It may, indeed, be very difficult to be sure, without a lumbar puncture, whether the cerebral symptoms accompanying an undoubted pneumonia do, or do not, indicate the presence of meningitis also. When meningitis is present the cerebro-spinal fluid is always altered in character and increased in amount.

The physical signs of pneumonic consolidation are the same in children as in adults. They are generally distinct by the fourth day; but, in some cases, careful and repeated examination fails to discover any before the sixth, or even the seventh day. In such cases, the acceleration of the breathing is usually also long of beginning. In children

with high fever, digestive disturbances and irritation about the gums, one should continue, as long as the fever lasts, to suspect the possible presence of a patch of pneumonia and examine repeatedly for it.

Complications.—The most important complication of pneumonia is empyema. Otitis media is probably the commonest, and it often occasions no pain. Pneumococcal pericarditis is rare in older children; but in young infants it is a not uncommon cause of death, though it is very often overlooked owing to the absence of friction sounds. Pneumococcal meningitis and peritonitis, as already mentioned, occasionally occur. Gastro-enteritis, nephritis, and arthritis are sometimes met with; and, in cachectic children, gangrene of the lung may supervene. Rarely, temporary paralysis of the sixth cranial nerve occurs. Occasionally abscesses form in the retro-peritoneal connective tissue or elsewhere, as the result of pneumococcal infection; and, whenever obscure signs of inflammation in any situation are found within a few weeks of an attack of pneumonia, the possibility, or probability, of their being due to pneumococcus infection should be borne in mind.

The **prognosis** in croupous pneumonia in older children, who have been previously healthy, is very favourable, considering how ill the child generally seems to be. Unless he is very feeble, or the disease complicated, or a large area of one or both lungs affected, the case is almost certain to end in recovery. When death occurs in simple pneumonia it is nearly always due to heart-failure. The great importance of the characters of the pulse in the prognosis of this disease has already been discussed (p. 468).

In some children pneumonic consolidation persists for many weeks or even for months, and, after arousing suspicions of tuberculosis, clears up entirely. Children are not uncommonly met with who, though otherwise robust, have a special liability to pneumonia and who, during the few years they have lived, have had three or four attacks.

In children in whom the pneumonia occurs as a complication of measles, and in some epidemics of influenza, also in young children who have a lowered power of resistance, the prognosis must be very guarded. Under these circumstances the disease is apt to spread to the other lung, to be followed by empyema,

pericarditis, pneumococcal meningitis, or some other serious complication. In babies especially, it may end in a condition of general pneumococcal septicæmia.

Treatment.—Most sporadic cases of croupous pneumonia, in previously healthy children, are not serious and need no special treatment. The disease is self-limited and has a strong tendency to recover; and all that is usually necessary is that the child should be kept lying in bed in a well-ventilated room, or in warm weather in the open air, and be regularly and judiciously fed and nursed. Overfeeding must be avoided, alcohol is unnecessary, and sitting up should be discouraged except in slight cases. Complications and special symptoms have to be watched for and treated when they arise.

The main symptoms which require active treatment are specially high temperature, pain, sleeplessness, cough, and threatening heart-failure.[1]

(*a*) *Pyrexia.*—Generally the fever requires no special treatment. If the temperature, however, remains for long over 104·5, or if hyperpyrexia occurs at any stage, something must be done to reduce it. Otherwise there is a risk in the former case of the heart-muscle suffering, and in the latter of convulsions setting in. A specially high temperature sometimes occurs at the beginning of the attack, and this is usually best treated by a dose of Dover's powder. In the later stages of the disease opium is to be avoided, and the administration of alcohol in moderation is indicated, along with tepid sponging or a cold pack. Coutts recommends a rectal injection of cold water (75° F.). Antipyretic drugs should rarely be used. I have not seen any good result from attempts to cut short the fever by means of drugs. Prolongation of the pyrexia, and hyperpyrexia, may both be attributable to otitis media.

(*b*) *Pain.*—This is generally best treated by a linseed poultice with or without mustard, or by hot fomentations. Severe pain at the beginning in older children generally yields rapidly to a dose of Dover's powder. The application of two or three leeches, or wet cupping over the site of the pain, are often also successful in relieving pain.

[1] J. A. Coutts, "Some Observations on the Occurrence and Treatment of Lobar Pneumonia in Young Children," *Edin. Med. Journ.*, Sept. 1902, xii., 209.

(*c*) *Insomnia.*—In older children in the early days of the disease, Dover's powder is also most effectual for insomnia. Later, if the patient is collapsed, alcohol is indicated. If the pulse is fairly good, antipyrine may be given cautiously, and is sometimes very successful. The sleeplessness, especially in young children, may be due to a loaded bowel, and a warm enema or a dose of castor oil or calomel, forms the best treatment.

(*d*) *Cough.*—The cough may be treated by poultices or the use of a steam-kettle. Should bronchitis be present, as happens much more frequently in children than in adults, an ordinary ipecacuan and ammonia cough mixture, with or without paregoric, may be given (Appendix I., Form. 28 to 30).

(*e*) *Heart-failure.* — When this threatens, it should be energetically dealt with by alcohol, caffein, ammonia, and ether. In severe cases it is probably always well to give digitalis in full doses from the beginning, and the child should be kept constantly lying and not allowed to sit up. When the right side of the heart shows signs of dilatation and the liver is enlarging from passive congestion, venesection, and the application of from four to eight leeches over the præcordium or right hypochondrium, are measures of the greatest value, and should always be employed. A calomel purge is often a useful auxiliary measure. When there is much cyanosis, the inhalation of oxygen is often beneficial.

(*f*) *Flatulence.*—If there is much flatulent distension of the abdomen, it may be necessary to stop all milk for a time.

No single therapeutic measure in the treatment of pneumonia has such a powerful effect for good as the free use of open air, and the patients do best who are nursed near a widely open window or, better still, on a balcony.

During recent years a variety of laboratory methods of treatment have been made use of with varying success. Hiss and Zinsser[1] have recommended the injection of leucocyte extract which they have found beneficial. Stoner[2] and others have used autogenous or stock vaccines also, sometimes with good results; and Freeman[3] and many other observers have

[1] *Journ. Med. Research*, 1908, xix., No. 3, 321.

[2] *Amer. Journ. Med. Sci.*, 1911, cxli., 186.

[3] *Amer. Journ. Dis. Child.*, Dec. 1912, iv., 391; and *Amer. Med.*, June 1913, viii., No. 6, 433.

reported favourable effects from using a pneumococcus serum. Other writers who have used these methods have not been so successful. These measures are still on probation and certainly deserve further trial. I have had no experience of them.

A short account of recent bacteriological work on the *different types of pneumococci* and on the use of *serum* in pneumonia will be found in Appendix F.

Broncho-Pneumonia.

Broncho-pneumonia may occur as a primary disease, or it may be secondary to such infectious diseases as whooping-cough, measles, influenza, and diphtheria, or to gastro-intestinal disorders. It is the form of pneumonia which occurs most frequently in early infancy, and about 75 per cent. of all the cases occurring in children under two years are said to be of this type. After four years, broncho-pneumonia is rarely met with as a primary disease (Holt). Debility is another influence which predisposes to the occurrence of this form of inflammation of the lungs.

Symptoms.—The mode of onset varies considerably in different cases. Generally the disease sets in as the culmination of a bronchial attack; often, however, the pneumonic symptoms come on quite suddenly without previous bronchitis, and we have high fever, vomiting, and sometimes a convulsion as in croupous pneumonia. The symptoms, however, are usually much more obviously pulmonary in character in this kind of pneumonia. The respiration is rapid and laboured, and it has a distinctly thoracic type; there is also more or less inspiratory indrawing of the lower lateral regions of the chest-wall. Cough is generally present—shallow, short, and hacking in character. The child is usually too ill to sit up or speak, and he gets short of breath upon the least exertion. Cyanosis is noticeable in severe cases. The fever lasts for from one to three weeks, and the temperature curve shows a remittent type and generally ends by lysis. The rise of the temperature may be only slight, especially in young and delicate children.

The physical signs are often quite indefinite at first—not differing from those of bronchitis of the smaller tubes. There may be no definite evidence of consolidation at this stage, the patches being too small to cause either dullness or bronchial

breathing. After a time, however, bronchial breathing, increased vocal resonance, characteristically sharp râles, and an impaired percussion note develop.

Complications.—Pleurisy is a less invariable occurrence in broncho-pneumonia than in the croupous form of the disease. It is met with, however, in most cases where the lung is extensively involved, and often goes on to empyema. Collapse and emphysema frequently occur, and gangrene of the lung is not very rare in cachectic children.

Diagnosis. — Broncho-pneumonia is to be distinguished from bronchitis by the general symptoms rather than by the physical signs. The higher range of the temperature, the greater rapidity of the breathing, the shorter and shallower nature of the cough, the indrawing of the chest-wall, the greater prostration, and the marked cyanosis are all characteristic of the graver disease.

In young children it is sometimes very difficult to decide which variety of pneumonia is present, and pathological experience teaches us that both forms may be present at the same time and even in the same lung. Generally we are helped in our diagnosis by considering the patient's age and strength. Young and feeble infants are more likely to have broncho-pneumonia. The temperature-chart is also helpful —a gradual onset, an atypical curve, and an ending by lysis are all in favour of broncho-pneumonia although by no means pathognomonic. When much bronchitis is present and when both lungs are affected, these points are also, so far, in favour of the diagnosis of broncho-pneumonia.

It is sometimes difficult to diagnose broncho-pneumonia from collapse, and to determine, when both are present, what proportion of the symptoms are attributable to each. Simple atelectasis is characterised by a low temperature, more or less marked cyanosis, and generally indefinite physical signs.

It may be quite impossible to discriminate, at an early stage, between an attack of simple and one of tuberculous broncho-pneumonia. The symptoms and physical signs may be practically identical in the two conditions. The occurrence of previous wasting, and especially the history of an attack of measles or whooping-cough some months before the present illness, are suggestive of tuberculosis.

Prognosis. — In estimating the prognosis in a case of broncho-pneumonia, we must take into consideration the following points:—

(*a*) The child's age—the younger he is, the more serious is the case;

(*b*) The state of his nutrition—the chances are far better in breast-fed than in bottle-fed babies;

(*c*) The state of the pulse—if the tension is low, it is a very bad omen;

(*d*) The form and consistence of the chest-wall—weak muscles and a soft-walled or deformed thorax greatly increase the danger;

(*e*) The extent of lung involved;

(*f*) If the pneumonia is secondary, the nature of the primary disease is important—*e.g.*, an attack of broncho-pneumonia after measles is much more likely to be fatal than a primary attack of apparently equal severity.

Treatment.—The main indications are as follows:—

(*a*) *Keep the patient warm* in bed and supply him with *plenty of fresh cool air.* The old-fashioned plan of having the windows shut for fear of a draught is a serious mistake. Draughts can easily be kept off by the use of screens, and so long as the child's extremities are warm, he will (if he has no laryngitis) get nothing but good from abundance of cold fresh air.

The great value of fresh air in the treatment of this disease was forcibly pointed out in 1904 by Dr Claude B. Ker in an important paper[1] on the results of open-air treatment in the management of broncho-pneumonia complicating whooping cough. Since then, many testimonies to its efficacy have been given in this country and in America.

When the windows are kept widely open, the appetite and digestion improve, and, with them, the general strength. The nervous tone is also better, and the child is less fretful and sleeps far more, and more soundly. The cause of this improvement is not yet thoroughly understood.

(*b*) *See that the nasal passages are as clear as possible.* If there is any nasal catarrh it is most important, especially in young infants, to use a simple alkaline and antiseptic lotion for the nose (Appendix I, Form. 31). Any nasal obstruction is apt to favour pulmonary collapse.

[1] *Scot. Med. and Surg. Journ.*, Jan. 1904, 33.

(*c*) *Avoid embarrassing the respiration* by heavy or tight clothing, and *encourage expectoration.* The continuous application of heavy poultices is not advisable; but an occasional mustard poultice followed by a light cotton-wool jacket, which must be frequently renewed, is often useful. A simple alkaline expectorant mixture (Appendix I, Form. 28) is usually distinctly helpful in rendering the phlegm more liquid and the cough easier. Moistening of the air, by the use of a steam-kettle or by hanging towels wrung out of hot water about the room, is also sometimes useful—mainly if the upper air-passages are affected. In fairly strong children, with slight pneumonia and much bronchitis, an occasional emetic may help considerably, but often the patient is too weak for such treatment. Opiates and most other sedatives are strongly contra-indicated. The administration of large doses of extract of belladonna ($\frac{1}{4}$ gr. every three or four hours), as recommended by J. A. Coutts,[1] has occasionally in my experience been very useful.

(*d*) *Conserve the general strength* in every possible way. Do not upset the digestion by overfeeding; give liquid food in small quantities at regular intervals. If a weakly infant refuses to take enough nourishment, he should be fed by a tube through mouth or nose.[2] Keep the child lying flat, and if the case is a bad one, do not let him tire himself by any unnecessary exertion. It is well, however, to have his position changed from time to time and, in slight cases, to let him sit up a little, so as to encourage free inspirations. It is particularly important never to weary the patient by any unnecessary physical examination. For the same reason the clothing should be such that it can be removed with as little exertion as possible on the part of the child. If he is weak, a cotton-wool jacket and an arrangement of shawls can often advantageously be substituted for a night-dress with sleeves.

(*e*) *Ward off collapse* by stimulant measures. In many, especially secondary cases, alcohol is necessary, and small doses of strychnine may sometimes be useful. Inhalation of oxygen is undoubtedly beneficial. When collapse threatens, a mustard pack is often of great service. Should the right side of the

[1] *Brit. Med. Journ.*, 1899, i., 207.

[2] Ibrahim, *Deuts. med. Wochenschr.*, 1910, No. 23, xxxvi., 1081.

heart become dilated, leeching or venesection may be urgently called for. This is, however, seldom indicated in this form of pneumonia.

(*f*) *Reduction of the temperature* is sometimes desirable, if it continues high. For this purpose cold sponging is preferable to the use of drugs.

(*g*) *Make sure of a complete convalescence* by the use of cod-liver oil and tonics; and, especially, by sending the child to the country for a time.

Collapse of the Lung.

Collapse of the lung is a common and important incident in the course of all kinds of respiratory disease in infancy. It is also frequently found after death in children who have died from debilitating disease of any kind, although no pulmonary symptoms may have been noticed.

Causes.—The special tendency to the occurrence of collapse in young children is explained partly by the soft and yielding chest-walls, the weak respiratory muscles, and the fact that coughing, in them, is largely a reflex act and is not aided, as in adults, by experienced voluntary efforts at expectoration. A smaller amount of bronchial secretion is therefore sufficient to obstruct seriously the free entrance of air into the vesicles; and narrowing of the upper air passages, such as occurs from adenoids, is more apt to have a deleterious effect on the lung expansion. The occurrence of abdominal distension from tympanites or any other cause is another factor frequently present in childhood. Areas of pulmonary collapse often become reinflated with air, with or without treatment.

Symptoms.—The symptoms of collapse vary according to the amount of lung involved. If a large area is suddenly affected in this way in the course of an attack of bronchitis, the respiration becomes very rapid, rising perhaps to 70 or 90 in the minute, the alæ nasi work violently, cyanosis appears, and the child is greatly distressed. The cough is less loud and harsh than previously, and the child shows signs of exhaustion. The temperature does not rise as in pneumonia, and may even fall.

The physical signs also change. The lower part of the thorax and the interspaces over the affected area are in-

drawn with each inspiration. The breath sounds are feeble and distant, and may become bronchial in character. In many cases it is impossible to diagnose collapse of the lung with certainty during life, but it may often be advisable to employ suitable treatment for it before it can be diagnosed with absolute certainty.

Treatment.—In treating a case of pulmonary collapse, we aim at the reinflation of the collapsed areas. To this end we endeavour to remove all impediments to the breathing, we try to increase the force of the inspirations as well as the child's general vigour, and at the same time we endeavour to diminish the viscidity of the secretions and lessen the spasm of the bronchi.

The child should lie with the affected side uppermost, and his clothes should be light and lie loosely on the chest and abdomen. He should not be allowed to sleep long or soundly, but should be wakened from time to time and made to cry. The strength of his inspirations may be increased by the sudden application of cold cloths to his chest and by rubbing it with a stimulating liniment (Appendix I, Form. 32). Easily absorbable nourishment, along with alcohol, ether, ammonia, or strychnine should be given to sustain the general strength. To liquefy the secretion, a steam-kettle and the administration of ipecacuanha and alkalies are useful, and belladonna in full doses often relieves spasm.

Pleurisy.

Dry pleurisy, and pleurisy with serous effusion, apart from pneumonia or tuberculosis, are comparatively rare in early infancy. In older children they are common, though less frequent relatively than in adults. Serous pleurisy is generally of tuberculous origin in childhood, but sometimes it is due to pneumococcal infection. Dry pleurisy is probably, in a few cases, of rheumatic origin. The other causes are those met with in adult life, and generally there is no important difference in the physical signs in children, except that there is often no recognisable friction. The general symptoms, even with a large effusion, are sometimes surprisingly slight. Cases are not uncommon in which the pleural effusion takes the form of such a thick layer of solid lymph that the dullness resembles that in collections of fluid or pneumonic consolidation.

The **prognosis** is generally good, especially if there is reason to think that the case is not tuberculous, but the process of recovery may be very slow. Even tuberculous cases often do well if the general conditions are favourable and they are energetically treated. The **treatment** does not differ from that in the adult.

Pneumothorax.

Pneumothorax is not a common condition in childhood, and is very rare in babies. It is met with under various conditions—(1) Pyo-pneumothorax, where the gas present arises from the decomposition of a septic pleural exudate, is sometimes found, though much less frequently than in adults. (2) Following exploratory puncture, in cases where there are pleural adhesions or partial consolidation of the lung. (3) Most commonly from the passage of air from the lung into the pleura, as the result of violent coughing. This may be due to the rupture of a tuberculous cavity or emphysematous patch; but it sometimes occurs in an apparently healthy lung, owing to sudden increase of the intrapulmonary pressure during very severe coughing—as in whooping-cough or measles (see Cutaneous Emphysema, p. 326).

In pyo-pneumothorax, incision and drainage are generally called for. In the cases due to violent coughing, no active measures are indicated beyond soothing the cough. I have seen several such cases end in apparently complete recovery.

Empyema.

Empyema is much commoner in children than in adults, and may occur even in the first week or two of life. It is often more insidious in its onset and more obscure in its symptoms than in later life. In children also, it is far less frequently tuberculous in origin, and it is more often met with in a localised form.

Causes.—The general condition of the child's nutrition is of great importance in determining the onset of empyema. It occurs frequently among the ill-nourished children of city slums under circumstances in which it is rare among the upper classes or in country children. It is often the sequel of scarlet fever, measles, or some other infectious disease, and it is most frequently met with after pneumonia.

In children far the commonest cause of empyema is the pneumococcus. Other pyogenic organisms, especially streptococci, are often to blame. The tubercle bacillus is rarely found.

Symptoms.—The symptoms vary in different cases. When the case occurs after pneumonia or one of the infectious diseases, there is generally a history of interrupted convalescence, with continuance or return of the fever, usually some cough, malaise, loss of appetite, wasting, and pallor. Often, however, it is difficult to get any account of a sudden commencement. In such cases the child is observed to fail in strength and appetite gradually; sometimes he vomits or his bowels are loose; sometimes he sweats much at night. Then he may develop a cough, and often the cough occurs in fits like whooping-cough. Sometimes there is a history of the child's being languid and hot at night, but often no sign of fever has been noticed.

Physical Signs.—On examining the chest, if the collection of pus is small and localised, there may be found only a patch of dullness with diminished breath sounds, and defective resonance. This patch is oftenest found near the angle of the scapula, but it may be situated in any region of the chest, and occasionally occurs over the apex in front, with resonant lung below it. If the pus is present in large amount, and is free in the pleural cavity, as is usually the case where the illness is of recent origin and has come on acutely, there is generally some bulging of the affected side with diminished movement. The heart may have been displaced by the pressure of the gathering fluid. In chronic cases the affected side is sometimes shrunk, owing to the pulmonary collapse which is present, and the heart is drawn towards the affected side. On palpation, auscultation, and percussion, we get the usual signs of fluid. The temperature may be raised, but it is frequently quite normal, and more or less marked leucocytosis is always present. If the empyema has lasted for any length of time, there is generally clubbing of the finger-ends. The occurrence of empyema on both sides of the chest is not very uncommon. In obstinate cases of empyema or abscess of the lung due to a foreign body, an X-ray examination may be of great assistance in revealing the real cause of the disease.

The only certain way of making a diagnosis, however, is to

use an exploring syringe, and this we should *invariably* do if in doubt. If one puncture fails to discover pus where there is reason to expect its presence, the process should always be repeated (frequently if necessary) either at once or at intervals of a day or two. With ordinary aseptic precautions, no harm results from the puncture. The only accidents I have seen are severe hæmoptysis and cutaneous emphysema. The former only occurred once and the latter in some half dozen cases. When emphysema takes place, it begins round the site of the puncture. It occurs when the needle passes through air-containing lung tissue which is adherent to the chest-wall, and it merely occasions a slight rise of temperature for a few days. Exploring for pus requires a larger syringe than is used for subcutaneous injections, and also a considerably larger needle than the ordinary hypodermic one. If the pus is thick, as in many chronic cases, an ordinary hypodermic syringe may entirely fail to reveal its presence.

Treatment.—The treatment of empyema consists, of course, in the speedy removal of the pus. It is generally well to begin by aspirating it, if the patient has been previously a healthy child. In strong children a single aspiration may suffice. When a small empyema re-accumulates slowly, a second aspiration may be tried. Generally, however, if one aspiration fails, the pleura should be incised. If the ribs are fairly wide apart, a simple incision, and subsequent draining with an india-rubber tube, will probably prove the best treatment, especially if the child is feeble. If the ribs are very close together, however, or if a simple incision has been made and the drainage from it is not satisfactory, it will be well to consider the advisability of resecting a portion of a rib. This has the disadvantage of generally necessitating the use of a general anæsthetic (which is more dangerous in these cases than in almost any others in childhood), but it has compensating advantages. It allows the masses of semi-solid purulent lymph, which are often found, to be more completely evacuated; it ensures freer drainage, and, last but not least, it makes the dressing a less painful process than in cases of simple incision when the tube fits tightly between the ribs. Washing out the cavity is never advisable, except perhaps in cases where the pus is offensive in character, and these are very rare in childhood.

If the operation is done in time and the cavity drains well,

the result is generally most satisfactory; and, in favourable cases, the tube may be removed in two or three weeks. Any rise of temperature generally signifies some interference with the drainage, and may require the use of a larger or a second tube.

Occasionally a staphylococcus infection of the wound causes a return of the fever and an increased discharge. This may prove obstinate, but it can often be very satisfactorily treated by the use of an autogenous vaccine. Another common cause of rise of temperature during recovery from empyema is the occurrence of a pneumococcus otitis. Infections of the peritoneum and meninges are occasionally met with; and, in young children who are poorly nourished, a spread to the pericardium is not very rare. In cases where treatment has been unduly delayed, a considerable amount of collapse of the lung may persist, and may lead in after-life to fibrosis and bronchiectasis.

Bronchitis.

Bronchial catarrh is extremely common in infants and young children, and is important, not only for this reason, but also because it is so liable in them to be complicated by pulmonary collapse and broncho-pneumonia.

Causes.—Cold and damp are common *exciting causes*, and also injudicious clothing and exposure. To avoid chills in examining infants, therefore, we should avoid exposing much of the surface of the body at a time, except in a warm room or in front of a good fire.

In many cases there are also important *predisposing causes* at work, and these have to be taken into account in the treatment. Rickets strongly favours the occurrence of bronchial as well as other forms of catarrh, and a protracted or recurring bronchitis may be due to this. In rickety cases the regulation of the diet, and other anti-rachitic measures, are of more importance in the treatment than cough mixtures. In other cases the recurrence of bronchitis is due to the presence of lithæmia, and sometimes the attacks may turn out to be of the nature of asthma.

Even in children who are not rickety, teething seems sometimes to predispose to bronchitis, and the advent of each new group of teeth is accompanied by an attack.

Another important predisposing cause of recurrent bronchial attacks is the presence of adenoid growths in the naso-pharnyx, and, as Lockhart Gibson and others have pointed out, the removal of these is often followed by comparative immunity from further recurrence of the bronchitis.

Symptoms.—The symptoms are much the same as in later life—a slight rise in temperature, a cough usually deep and loud, slight acceleration of the breathing, no dullness or bronchial breathing, loud sonorous rhonchi and bubbling râles if the larger bronchi are affected, and sibilant and crackling sounds if the smaller tubes are involved. They vary in severity not only with the size of the bronchi affected and the stage of the attack, but also with the strength of the patient. In wasted and weakly infants the symptoms are less severe, although the real danger is much greater than in those who are robust. If the child's cough and cry are loud, the case is not yet a serious one.

Treatment.—In treating a baby with acute bronchitis there are two main indications. *First*, the strength must be sustained, and depressing influences guarded against. The temperature of the room should be kept about 60° F., and be very well-aired, although all direct draughts are to be avoided. The diet must be as nourishing and digestible as possible, and if the baby is refusing food, or if the case is a severe one, stimulants may be advisable—alcohol, ammonia, and strychnine.

Second, the patient must be assisted to get rid of the excessive bronchial secretion which constitutes an element of danger to him, by the secretion being rendered more fluid and the natural methods of its expulsion aided. This indication may be fulfilled in various ways—

(*a*) The air he breathes should be moistened by having a steam-kettle playing close to his bed, or by hanging up near it, from time to time, ordinary towels wrung out of hot water.

(*b*) Hot fomentations may be applied to the chest if the case is acute, or perhaps better, a mustard poultice or pack followed by a cotton-wool jacket; or a stimulant embrocation (Appendix I, Form. 32 and 33) may be used.

(*c*) In the early stages small doses of ipecacuanha wine should be given with an alkali. Later, such stimulant

expectorants as carbonate of ammonia and squills are indicated, and a sedative may sometimes be added with advantage (Appendix I, Form. 30).

(*d*) When, in a strong child, the secretion is copious and the patient is not vomiting spontaneously, an occasional emetic may give marked relief. If the baby can be easily made to vomit by tickling his fauces with a feather, this is better than giving an emetic.

(*e*) The baby's clothes must be warm, and should not be so tight as to interfere with the full play of his chest in breathing and coughing.

When the attack is over, it is always most important to see that the child's health is thoroughly restored, and not to be contented with an incomplete convalescence. The use of cod-liver oil and tonics and a change of air may be very desirable.

Bronchiectasis.

Dilatation of the bronchi is a recognised complication in various organic diseases of the lungs and pleuræ in children. In many of these the condition is only recognisable after death. Typical cases of bronchiectasis, resembling those met with in adult life, are not at all rare in childhood although not always easy of diagnosis. Sometimes the disease sets in after an attack of measles or whooping-cough or some other acute affection; and sometimes after pulmonary collapse or empyema. In other cases it seems to develop independently.

The **symptoms** are the same as are met with in adult life. The cough is characteristically spasmodic, like that of whooping-cough, and is apt to be set up whenever the child assumes certain positions. The sputum is also characteristic, very copious, of a greyish yellow colour, and sometimes, though by no means always, it has a peculiar sour or a fetid odour. The characteristic sputum is apt to be overlooked at first, because the child swallows it. Sooner or later, however, vomiting occurs, and the purulent sputum can then be recognised in the vomit. Blood is found in many cases in the sputum. The temperature is sometimes normal, but usually it is subject to periodic rises. The fingers become early and severely clubbed. In the later stages cyanosis usually develops. Patches of pneumonia are a common complication.

The physical signs are as in the adult. It is characteristic of them that they vary much from day to day. When one lung is badly affected, the physical signs are sometimes so freely transmitted across the chest that the other lung seems to be affected also.

The **treatment** of severe bronchiectasis is even more unsatisfactory in children than in adults. In them, sufficiently prolonged creasote inhalations and intra-tracheal injections of various kinds are inadmissible. When the expectoration is copious, some advantage is sometimes derived from inverting the patient in the morning, so as to facilitate the emptying of the matter which has accumulated during the night in the bronchiectatic cavities.

If the sputum is offensive, turpentine may be given internally in doses of 3 or 4 minims three or four times a day. Generally, however, the only necessary treatment consists in close attention to the digestion and general health, in the administration of cod-liver oil and tonics, and in arranging for the freest possible access of fresh air.

Asthma.

Age of Onset.—The accompanying chart (Fig. 150) gives a graphic representation of the age at onset of the symptoms in one hundred cases of asthma in children under fourteen years, so far as this could be ascertained from the parents. It certainly puts the beginning of the disease somewhat later than it really was in many of them, for the early symptoms often pass unrecognised. It shows in a striking way to what an extent asthma is to be regarded as a disease of early childhood, and therefore emphasises the importance of our always being on the outlook for its earliest manifestations. We see from it that the disease frequently sets in in the first twelve months (in two instances it began as early as the fourth and sixth weeks of life); and that, in most of the cases, symptoms of its presence were noted before the end of the fourth year. Comparatively few of them began in later childhood.

Sex.—Asthma is commoner in boys than in girls. In these one hundred cases the ratio was exactly 3 : 2.

Family History.—The health of the child's immediate relatives may be interesting; for we often get a history of several of them having suffered from asthma, hay-fever, eczema,

urticaria, or gout, or having had idiosyncrasies for some common forms of food, such as eggs, fish, the flesh of fowls, or oatmeal. Asthma is much commoner in well-to-do families than among hospital patients.

Accompanying Diseases and Complications.—The patients themselves, also, have not uncommonly suffered, and may still be suffering, from eczema or some other skin disease, from nervous affections, from naso-pharyngeal obstruction, or from an organic chest affection or a digestive disturbance. Thus, in the one hundred cases, twenty-six had a history of eczema (usually in infancy and sometimes later), eight of urticaria, two of ichthyosis, one of psoriasis, five had had enuresis, one of them also fæcal incontinence, two had had fits, one was suffering from habit-spasm, two of the older cases had hay fever, and two suffered from abnormal obesity. In at least seventeen of the cases there were, or had been, enlarged tonsils and adenoids, in two there was distinct evidence of enlargement of the bronchial glands, in one of pleural adhesions, and in two of chronic pulmonary disease. In many of the cases there was more or less emphysema and, in some, a degree of cardiac dilatation. In several, idiosyncrasies for eggs and other foods had been noticed.

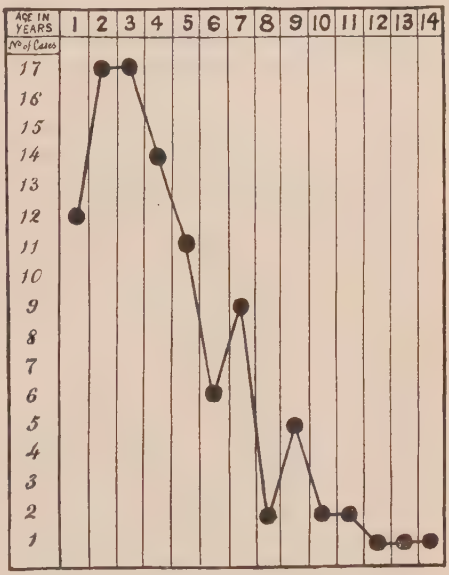


FIG. 150.—Age at onset of Asthma in 100 cases.

Some of these concomitant diseases and symptoms, such as the cutaneous and digestive disturbances and the food idiosyncrasies, are of special interest as indicating the frequent dependence of the bronchial spasm on anaphylaxis; some show merely the generally irritable state of the nervous system, while others, like the naso-pharyngeal obstruction and the intra-

thoracic lesions, probably have a causal connection with the asthma. The emphysema and the dilatation of the heart are obviously secondary to the respiratory distress.

Etiology.—The causation of asthma, as already indicated, is closely connected with a process of anaphylaxis (see Appendix C). The patients are, temporarily or continuously, in a state of sensitivity to some form of protein. In a large proportion of the cases the protein in question is contained in some special animal or vegetable food, for which the patient has an idiosyncrasy, and is absorbed from the alimentary canal. In others the offending substance is inhaled in the form of the dandriff, hair, or feathers of some animal, or the pollen of common grasses or flowers; and it may also be derived from pathogenic micro-organisms growing in some part of the body, such as the nose, throat, or intestine.

In recent years it has been found possible to ascertain which protein is to blame by means of a simple skin test. An abrasion, such as is used in von Pirquet's tuberculin test, or a small cut, $\frac{1}{8}$ in. in length, and not deep enough to draw blood, is made on the flexor surface of the forearm. On this is placed a single drop of a solution of the protein to be tested, in a decinormal solution of sodium hydroxide. Another similar abrasion or cut is made as a control, and to it only the sodium hydroxide solution is applied. After half an hour the solution of the protein is washed off, and the reaction noted. If it is positive, a raised white area or an urticarial wheal at least ·5 cm. in diameter, is found surrounding the abrasion. The most important forms of protein to try in this way are those of common foods, such as eggs, milk, various meats, cereals, and potato, and those of horse-hair, feathers, pollen from the commoner grasses, varieties of staphylococci and streptococci, pneumococci of types I and IV (see Appendix F), and the diphtheroid bacillus. In cases of an idiosyncrasy for eggs, the inunction of raw white of egg into the unabraded skin may give a very definite reaction in the form of urticarial wheals.

Exciting Causes.—In children who are predisposed to asthma the attacks are frequently brought on by catarrh of the upper air-passages, or by dentition, sometimes, though probably not so often as in adults, by dyspepsia, and often by taking eggs or some other special food. In one of my older cases excitement, laughter, and loud talking always set up an attack.

Dust and emanations from the skin of certain animals such as the horse or cat may start one.

Predisposing Causes.—Climate is sometimes important in connection with the causation of the symptoms; and, as in adults, the place which suits one child best may be bad for another.

The presence of emphysema seems to have a strongly predisposing influence; and this probably accounts for the frequency with which a first attack occurs after whooping-cough or some other severe respiratory disorder.

Symptoms.—When asthma begins in infancy or early childhood, its earliest manifestations are often obscure, largely because they are associated with so much catarrh. The attack generally assumes the characters of acute bronchitis, but there is frequently a good deal of paroxysmal sneezing with it, its onset is curiously sudden, and there is apt to be wheezing, as well as urgent coughing. Usually some rise of temperature occurs, and the breathing may be so rapid (40 to 100) that broncho-pneumonia is often diagnosed. This diagnosis may be supported by the severity of the dyspnœa, cyanosis, and prostration. These urgent symptoms may pass off rapidly within twenty-four to forty-eight hours, and this, along with their recurrence on subsequent occasions without any definite evidence of consolidation developing, clears up the diagnosis. The attacks vary, of course, in frequency and in severity. During the intervals minor paroxysms may occur, but the children are often surprisingly well.

As the child grows older the catarrhal symptoms become less and less prominent and the temperature less often rises, while the evidence of bronchial spasm is more evident. By the time the child is five or six years old, the asthmatic character of the attack is unmistakeable.

In cases in which the disease begins in later childhood the attacks generally resemble those in adults from the first, and there is little difficulty in recognising their nature.

The **prognosis** is usually more favourable in those cases in which the disease begins in early childhood; but the cases which are set up by odour, pollen, and special foods are often obstinate. When the symptoms are secondary to emphysema, or when the attacks have been allowed to go on unchecked until emphysema has developed and the heart

is dilated, satisfactory recovery is much less likely to occur. In most cases in which the lungs are not badly damaged, the chances of recovery, at least before puberty, are very good, provided suitable treatment has been carried out.

Treatment.—The treatment of asthma may be considered under three heads:—(1) that of an acute attack which has begun; (2) that when an attack threatens; and (3) what is most important, the measures to be taken during the intervals between the attacks, to prevent their occurrence.

(1) *The Acute Attack.*—The patient must be put to bed in an airy room, and an expectorant and diaphoretic mixture given for the catarrh. A large mustard poultice, composed of one part of mustard and from two to four of linseed meal, according to the child's age, often gives great relief. It should be left on until the skin is well reddened, but, of course, must not be too often repeated. Should there be reason to suspect the presence of undigested food in the stomach or bowels, it will be well to administer an emetic or purgative at an early stage.

In a severe case—say, in a child of five or six years—the hypodermic injection of adrenalin solution (3 to 5 minims) is probably the most effectual remedy and often brings the symptoms rapidly to an end. A hypodermic of morphine ($\frac{1}{12}$ gr.), or the inhalation of chloroform, may be similarly useful. In cases in which the symptoms are less urgent, antipyrine (3 to 6 grs.) with chloral (3 to 8 grs.) or bromide of soda (8 to 12 grs.) may be given. The fumes of nitre paper or of stramonium leaves, which are constituents of most patent inhalation cures, are often helpful.

(2) *A Threatened Attack.*—In children who are subject to asthma, much may be done to ward off an attack by warmth, prompt attention to the digestion and bowels, and the timely administration of antipyrine, bromide, and iodide.

(3) *Between the Attacks.*—Far the most important treatment of asthma is that to be given between the attacks, to diminish their frequency and severity, and, if possible, to stop them altogether.

Older Methods of Treatment.—Formerly, before anything was known about anaphylaxis and its relation to asthma, a number of measures were employed which, in many cases, met with considerable success. They are still valuable, and often form the only treatment available.

They may be summed up as follows:—(1) Attention to the Hygiene and General Health; (2) Treatment of any Local Disease; (3) Regulation of the Diet and Habits of Eating and Drinking; and (4) Administration of Medicines.

(1) The *Hygiene and General Health* should always receive attention. When possible, it is well to have the child removed to a warm dry climate; and, in any case, it is important to ascertain, as soon as possible, how far the symptoms are influenced by such climates as are available. In some cases, no change of air has any effect. In others, changes make a great difference in the frequency and severity of the attacks; and removal to a place that suits the child better may stop the asthma altogether. Sometimes the seaside agrees best; often, however, the sea air aggravates the symptoms, and hill air, at a moderate elevation, is more beneficial. Some cases do best in a town, others are only well in the country. When a place is found that suits the child, it is important to let him have the advantage of living there as much as possible, as long intervals of immunity are often obtained in this way, and these go far toward breaking the habit of the disease and preventing permanent emphysema.

(2) Any *Local Disease* that is present must be dealt with. Precautions should be taken to avoid and to treat at once any form of recurrent catarrh. In a few cases operations on adenoids or unhealthy tonsils are followed by improvement —probably because they remove a source of repeated infection. Local suppuration may aggravate the symptoms. If there is indigestion, means should be taken to remove it.

(3) The *Child's Diet and his Habits of Eating and Drinking* should be regulated. The meals should be moderate in size, and the intervals sufficiently long to allow the stomach to be emptied before the next food is taken. An excess of butcher-meat or of sweets is to be avoided. In older children, the food should be given as dry as possible, and fluids mainly when the stomach is empty. Of course, any form of food which has been found to disagree must be strictly forbidden. Parents do not always realise the importance of this obvious indication.

(4) Several *Medicines* are of considerable value. In many cases, great improvement follows the regular use of small doses of iodide of potash (1 to 4 grs., twice or thrice daily). The effect of iodide is often striking; even very small doses

of it may enable a child to remain free from the attacks in a place where, without them, they constantly recur. Liquor arsenicalis (1 to 3 minims, thrice daily) and cod-liver oil are also beneficial. In some young children with a tendency to lithæmia, a course of salol (1 to 3 grs.) with bicarbonate of soda (3 to 6 grs.) given thrice daily an hour before food, will greatly lessen the frequency and severity of the attacks.

The New Methods.—The knowledge of the frequent dependence of asthma on anaphylaxis has led to the introduction of more scientific therapeutic measures being suggested. These have already proved of great value in many instances, and will probably soon occupy a recognised place in the treatment of most cases of asthma. We have not as yet, in this country, had a very long experience of their use.

If the skin test shows a decided reaction to the protein of any food which the child has been taking, the effect of stopping it altogether should first be tried. In many cases, this is followed by a complete cessation of the attacks. When the effect of any food on the symptoms has been proved in this way, it is desirable, if possible, to attempt to desensitise the patient by accustoming him very gradually to it. This may often be effected by administering it to him in minute doses at short intervals over a long period, until he becomes immunised to it. The initial dose for this purpose must be very small indeed (*e.g.*, 1 mg., or even less, once a day), for it is necessary to begin below the limit of tolerance and work up very gradually to larger doses. The treatment is, of course, very tedious, and requires so much patience and perseverance on the part of those in charge, that it is not always possible to get it properly carried out.

When the attacks arise from the inhalation of pollen or of animal emanations, and the patient cannot be kept away from the cause of his attacks, desensitisation may be attempted by gradually increasing hypodermic injections of the protein concerned, at intervals of a few days.

If there is any reason to blame the presence of pathogenic micro-organisms anywhere in the body, the injection of small doses of an autogenous vaccine should be tried, and is often completely successful.

Diseases with Laryngeal Symptoms.

The main characteristic of laryngeal disorders in childhood is their tendency to be associated with spasm; and it is chiefly the various forms of laryngeal spasm that we shall consider here. I shall not take up the important subject of laryngeal diphtheria; and laryngismus has already been dealt with in the chapter on Spasmophilia. Simple acute laryngitis, also, which is not uncommon in childhood and which may be met with at all ages—even occasionally in young babies—need not be dealt with, as it does not differ importantly from the same condition in later life. Of chronic laryngitis the same may be said. It may, however, be repeated that when it is met with in early infancy it should always arouse suspicions of the possible presence of syphilis.

Laryngeal affections, owing to the noise they make, are always likely to be noticed early; and they are apt to cause anxiety, because they suggest the question, "Has the child got croup (*i.e.*, laryngeal diphtheria)?" The most important causes of stridorous breathing in early childhood—apart from diphtheria, laryngismus, and adenoids—are false croup, congenital stridor, enlarged bronchial glands, and laryngeal papilloma.

False Croup (*Spasmodic Croup, Catarrhal Spasm, Laryngitis Stridula*).

This condition may occur any time between the ages of nine months and ten years, or later, but is commonest between two and six. Although it is not really a serious disease, it often gives rise to great anxiety.

Symptoms.—The onset of the attack is sudden and almost always occurs during the night. The child, who has usually shown signs of slight catarrh, wakens flushed, frightened, and with a metallic cough and loud croupy breathing. The cry is not much affected, but the child is somewhat feverish (about 101° F. or so) and perspiring, and seems distressed. The fauces show only a slight catarrh.

After an hour or two the child becomes quieter and falls asleep. When he does so, or even when he merely becomes less anxious, the respiration is at once much easier—proving the distinctly nervous character of the ailment. A second

attack often follows on the same night, and the symptoms are also apt to recur about bedtime on the following evening. Thereafter they generally give place to those of an ordinary cold. A child who has had one attack of this kind is liable to have others. Occasionally the disease recurs at intervals for years; and in many instances several children in a family are affected.

Diagnosis. — False croup is to be distinguished from diphtheritic laryngitis by its sudden commencement, its less severe character, and the more markedly spasmodic nature of the symptoms; also by the appearance of the fauces. In doubtful cases the history of previous attacks of a similar nature in the patient, or even in other children of the family, is reassuring. It must be remembered, however, that in rare cases real croup may begin with symptoms very like those of false croup, and that it is comparatively common to have attacks of *measles* and whooping-cough commencing in a similar way.

Laryngismus stridulus should never be mistaken for this condition. The patients are younger, the spasms are shorter in duration, though recurring frequently through the day. Cough, fever, and coryza are absent, and there are almost always symptoms of rickets, often facial irritability, and sometimes tetany or convulsions.

Treatment.—The main treatment of false croup consists in the application of warmth, internally and externally, to encourage the secretions and to soothe the child. Warm drinks are useful, and also the application of hot fomentations or poultices to the neck. It is also usually well to put the child into a warm bath and, in severe cases, to erect a steam tent. A simple expectorant mixture may be given. Should there be the least reason to suspect the presence of undigested matters in the stomach or bowel, an emetic (pulv. ipecac. 5 grs.) is indicated or a dose of castor-oil. Neither of them should, however, be given as a mere matter of routine.

Congenital Stridor (*Infantile Respiratory Spasm*).

This comparatively harmless affection is characterised by crowing breathing, a peculiar formation of the vestibule of the larynx, and, in advanced cases, by some thoracic deformity.

The characteristic stridor commences at birth or, at latest, within a week or two after the child is born.

Symptoms.—The stridor consists in a croaking sound which accompanies inspiration and rises to a high-pitched crow on quicker or deeper breathing. Expiration is usually noiseless, but sometimes, when the inspiratory noise is loud, it is accompanied by a short croak, and there is considerable inspiratory indrawing of the sides of the chest. There is, however, little movement of the alæ nasi and no cyanosis. The child is evidently in no distress, and looks about him quite unconcerned. The loudness and pitch of the crowing noise vary from time to time, and even in severe cases there are occasional short periods of intermission during which no sound is heard.

In slight cases the noise ceases during sleep, but when the stridor is severe it may last all the time. Any mental excitement increases it. It is not diminished by closing the nostrils or the mouth, but the introduction of an intubation tube stops it at once (Variot). The cry is loud and clear, and if a cough is present, it is quite normal in character.

During the early weeks of life, the stridor increases in loudness with the child's growth in strength. Thereafter it generally remains about the same till some time after the sixth month, when it spontaneously diminishes; and it passes off before the end of the second year in most cases. Latterly it is only heard on occasions of special exertion or excitement.

In all cases which have lasted for any time there is a characteristic deformity of the upper aperture of the larynx (Fig. 151), which consists essentially in a great exaggeration of the normal infantile peculiarities of the part (p. 495). The epiglottis is folded on itself, so that the aryteno-epiglottic folds lie close together and render the transverse diameter of the upper aperture of the larynx extremely narrow. In most cases there are no adenoid growths and the fauces are normal. If the stridor is severe and lasts for any time, a distinct degree of pigeon-breast is produced.

As the child grows up, the vestibule of the larynx retains the characteristic deformity long after the stridor has ceased. It can often be recognised in children of nine or ten years, and probably much later. When the breathing becomes normal, the thoracic deformity steadily lessens and finally disappears.

Causation.—The etiology of this condition has been much discussed, and as yet it is far from being thoroughly understood. The stridor has been attributed to posticus paralysis (Robertson) and to adductor spasm (E. Smith, Löri) due to adenoid growths or other local irritation, to enlargement of the thymus (Avellis, Hochsinger), and to congenital malformation of the upper aperture of the larynx (Lees, Sutherland and Lack, Variot, Refslund). The present writer and Dr Logan Turner have endeavoured to show[1] that, while the deformity of the larynx and the soft collapsable character of its structures are probably not without importance in the etiology of the stridor, the part which they play is only a secondary one; and that the essential and primary factor in the disease is not structural but functional. They hold that the principal cause of the obstruction is an ill-co-ordinated spasmodic action of the muscles of respiration, a choreiform respiratory spasm analogous to stammering—as distinguished from a laryngeal spasm. That such jerky forcible respiration would be likely to cause exactly this deformity, is proved by a simple experiment. The larynx of a new-born child is removed along with the neighbouring parts (Fig. 152). A bent metal tube, 18 in. in length, is then introduced into the lower end of the trachea; and in order to keep the chink of the glottis open a small piece of rubber tubing is at the same time placed between the vocal cords. When forcible inspirations are made through the tube, it is found that, with each, a striking alteration occurs in the upper aperture of the larynx, and that in many cases (as in Fig. 153) the resulting deformity is indistinguishable from that characteristic of congenital stridor.

FIG. 151.—Larynx of baby of 3 months who had suffered from stridor from birth, and died of exhaustion following diarrhœa.

[1] Thomson and Turner, "On the Causation of the Congenital Stridor of Infants," *Brit. Med. Journ.*, 1st Dec. 1900, ii., 1561; Thomson, *Edin. Med. Journ.*, Sept. 1892, xxxvii., 205; *idem*, art. "Stridor des Nouveau-nés," *Grancher and Comby's Traité des Maladies de l'Enfance*, 2me ed. iii., 113; Turner, *Brit. Med. Journ.*, 24th Nov. 1906, ii., 1485.

Diagnosis.—The recognition of congenital stridor is easy in typical and uncomplicated cases. Taking into account the character of the stridor, the age at which it began, the normal sound of the cry, and the absence of distress and of any other sign of disease, one can readily exclude such conditions as laryngismus, laryngitis, and laryngeal papilloma.

Two diseases which may give rise to somewhat similar symptoms are enlargement of the bronchial and tracheal

FIG. 152.—Larynx of new-born child; showing normal conformation.

FIG. 153.—The same; showing effect of sudden suction through metal tube on the shape of its upper aperture.

lymphatic glands and adenoid growths; both of these conditions occasionally occur in young babies.

The cases of noisy respiration due to *enlarged bronchial and tracheal glands* usually differ from those of congenital stridor in the following points: (1) The stridor is lower in pitch; (2) it is generally louder during expiration; (3) the up and down movements of the larynx accompanying the noisy breathing are less extensive; (4) the voice and cry are generally affected; and (5) there is usually marked cachexia present from the cause of the enlarged glands.

The croaking in cases of *adenoid growths* in young babies sometimes resembles that of congenital stridor rather closely.

In these cases also, however, it has a distinctly lower pitch, and there is usually a hoarse cry. Mouth breathing and other signs of nasal obstruction are also generally, though not always, noticeable. This form of croaking, unlike that of the real congenital stridor, is cured, or greatly relieved, by operation on the adenoids.

Prognosis. — Congenital stridor, when uncomplicated, is always recovered from. It must, however, be remembered that, if children with this condition acquire any acute respiratory disease, the abnormal state of the larynx may act as a serious complication.

Treatment.—The only rational treatment of simple cases of this condition consists in careful regulation of the diet and of the general hygiene.

Laryngeal Papilloma.

This is a rare affection, and does not generally produce symptoms till the child is two or three years old or more, although the disease is believed to originate at an earlier period. The main symptoms which characterise it resemble those of severe chronic laryngitis — stridorous breathing, a hoarse cry, and a croupy cough; and they gradually get worse in spite of treatment. In young children it may be practically impossible at first to make sure of the diagnosis.

Treatment.—In young children surgical removal of the papilloma either by intra-laryngeal operation or by thyrotomy is often fatal from pneumonia or otherwise; and even if it is successful at the time the growth is apt to recur. Tracheotomy, and the wearing of a soft rubber tracheotomy tube for some years has hitherto been regarded as the best treatment. At the end of this time the growths are sometimes found to have disappeared spontaneously. Should they persist, a thorough operation can then be carried out, with less risk of complications and with a fair prospect of a permanent cure. According to Dr Payson Clark,[1] no radical operation should be attempted until the child is at least ten years old.

In recent years great advantage has been found from treatment by radium.

[1] *Boston Med. and Surg. Journ.*, Oct. 1905, cliii., 377.

CHAPTER XXVII

ON SYMPTOMS AND SIGNS CONNECTED WITH THE NERVOUS SYSTEM

THE majority of alarming nervous and mental symptoms in young children are not caused by organic disease of the nervous system at all, but arise from disorders of other systems, or from such general morbid conditions as pyrexia, toxæmia, or uræmia. It takes very little to disturb a child's nervous system so thoroughly that the localising symptoms of disease in chest, abdomen, or elsewhere become obscured. We have, therefore, to get into the habit of discounting the nervous manifestations present before we can justly estimate the meaning of the symptoms of acute disease in little children.

Structural disease of the nervous system is, however, not uncommon in early life, and occasionally gives rise to very obvious symptoms; but often its clinical manifestations are curiously slight and equivocal.

Examination of Nervous Cases.

When a child has to be examined as to the presence of disease of the nervous system, the necessary inquiries may be divided into three groups:—

1. Investigation as to the occurrence of *cerebral or nervous symptoms*. We may ask about any change noticed in the child's disposition and temper and whether he has been drowsy or delirious. We should also inquire about pain in the head or elsewhere, photophobia, giddiness, and sudden screaming. He may have been heard to sigh, or grind his teeth, and he may vomit, be constipated for the first time, or have convulsions.

2. The patient has to be examined for *physical signs*. We have already discussed the significance of the characteristic

change in the physiognomy, of distended cranial veins and a bulging fontanelle, and of a slow and irregular pulse.

The state of the pupils must be noted and the presence of any nystagmus or squint; and the ophthalmoscope should be used. A distinct degree of cervical rigidity or opisthotonos is always of great importance.

The limbs are to be examined as to their sensibility and the presence of paralysis, rigidity, ataxia, and tremor or other involuntary movements. The state of the superficial reflexes and knee jerks should be ascertained and the electrical reactions tested.

3. Previous occurrence of *such illnesses as are known to be often followed by nervous or mental disease* should be inquired about. Thus, the former presence of chronic middle-ear disease has great importance in suspected cerebral abscess, and if tuberculous meningitis is possibly present, the fact of the symptoms following whooping-cough or measles is in favour of this diagnosis.

Some of the more important symptoms and signs of nervous disease may now be considered more fully.

Changes in Disposition and Temper.

Great irritability with a marked change in character is often noticed during the prodromal stage of tuberculous meningitis. This is not always, however, of much help in diagnosis, as somewhat similar mental disturbances are equally characteristic of various other abnormal conditions. Unwonted irritability is seen during the onset of most acute ailments and in a more chronic form in some cases of dyspepsia, chronic diarrhœa, and chronic nephritis. It is an especially characteristic manifestation of lithæmia.

Screaming.

In young infants, continually recurring paroxysms of screaming may be caused in various ways. Most frequently they are due to flatulence and colic (p. 126); occasionally they are set up by the irritation of uric acid in the urine or of preputial adhesions; and sometimes they are a symptom of an ill-developed brain with severe mental defect.

In older infants and young children also, screaming is a

common and characteristic symptom. Its causation differs greatly in different cases.

A. It may be due altogether to *bodily causes.*

1. It is often a natural manifestation of acute spontaneous pain in some part of the body—such as is produced by intestinal or renal colic, rectal spasm, acute otitis media, or any other distressing form of spasm or acute inflammation.

2. It may occasionally arise from intra-cranial disease without any pain. A shrill piercing scream—the "hydrocephalic cry"—is one of the classical symptoms of tuberculous meningitis; and a similar loud cry sometimes occurs in chronic hydrocephalus when the fluid is increasing rapidly.

3. When violent outbreaks of passionate screaming occur in little children without apparent cause—especially in those who are well brought up and have not hitherto had any similar attacks—it is most important to remember that, in a large proportion of cases, some latent disturbance of the general health is to blame for such attacks, and that simple medical treatment will usually stop their recurrence. Generally the fault is connected with indigestion or lithæmia, but it may be due to toxæmia, such as arises from bacillus coli invasion of the urinary tract, or staphylococcus infection of the throat or nose. Such ailments may set up a continuous, though probably unrecognised, feeling of discomfort with great hypersensitiveness, so that the most trivial annoyances arouse violent emotion. In dyspeptic cases, the common nursery prescription of a dose of castor-oil often does good for the time; and in those due to lithæmia, the regular use of bicarbonate of soda and salol will usually work wonders in restoring the child's equanimity and preventing any recurrence of the attacks. When the irritability is due to a bacterial infection, minute doses of a suitable vaccine may be equally effective.

This type of screaming is common in mentally defective children; but, in them especially, it is often impossible, before the effect of treatment has been tried, to make out whether the main cause of the disturbance is bodily or mental.

The paroxysms of screaming which are associated with night terrors (p. 566) may also be included in this group.

B. The screaming may be due altogether to *mental causes.*

Recurrent paroxysms of screaming are in many nurseries a familiar climax to states of ill-temper with loss of self-control,

and they are usually due largely to want of sense and sympathy on the part of those in charge. In some children, such "tantrums" are successfully treated by prompt corporal punishment. In many instances, however, in thoughtful children who are not spoiled, the outbreak is not due to naughtiness: the child himself is puzzled by the vagaries of his unconscious self and seems as much troubled by his own behaviour as his parents. In these circumstances corporal punishment is both unsuitable and useless; and the management of the attacks requires much knowledge of the individual child and the highest type of mothercraft. It is necessary to bear in mind the child's instinctive tendency to self-display, and the gratification he derives from making an impression on his seniors. This element may play only a small part in some children, in others it bulks largely. In all cases it is advisable that any worry or annoyance that is felt should be concealed, and that the screaming attacks should never be spoken about in the child's hearing. Often the mother learns to recognise premonitory symptoms which indicate that an attack threatens, and she may be able to avert it by getting the child to do at once some little action which will divert his mind from the subject. She may, for example, get him to take a definite number of long breaths, to go and sponge his face with cold water, or to fetch something from the garden.

In some instances the presence of morbid fears may be the real cause of the screaming (p. 568).

Drowsiness.

Drowsiness is an important symptom in intra-cranial disease. In tuberculous meningitis it sometimes occurs at the onset, and it is always a prominent feature in the later stages. After epileptiform convulsions the patient is often drowsy for many hours; and, if the fits occur in a long series at short intervals, the drowsiness may be so severe and last so long that, even in cases in which the brain is not permanently damaged, the child may look as if he were becoming an idiot (Fig. 154). Extreme drowsiness is also a characteristic phenomenon in thrombosis of the cerebral sinuses and in epidemic stupor.

In very many cases, drowsiness is not a sign of brain-disease at all. It is characteristic of various food-disorders,

acid-intoxication and uræmia, and occurs in hepatic and gastric disorders, and to some extent in most cases of high temperature.

It may also, of course, be the result of medicine (*e.g.*, bromide); and, when it is present in severe illness, it is always well to make sure that it is not merely due to excessive doses of alcohol.

FIG. 154.—Prolonged Stupor following repeated Idiopathic Convulsions in a boy of 6 months. The child entirely recovered.

Coma.

Coma is almost always a symptom of the gravest significance. It occurs in diabetes, in uræmia, in liver-atrophy, in intra-cranial injuries, and many other diseases, including eclampsia, and in various forms of poisoning.

Delirium.

Delirium is not uncommon in feverish conditions in childhood, and it may be recognised even in young babies by watching their gestures and expression (Fig. 11). Its occurrence in any case depends less on the degree of fever than on the kind of nervous system the child has, and on the character of his illness.

Some children become delirious if their temperature rises at night to 101° or even to 100° F., while others can stand a temperature of 106° F. without getting light-headed. Proneness to delirium at comparatively low temperatures is probably an indication of an unstable nervous system.[1] In some febrile diseases, such as pneumonia, if there is much debility, the delirium may continue for a day or two after the temperature has become normal.

Although a recognised symptom in both tuberculous and non-tuberculous meningitis, delirium is much more frequently

[1] Clouston, *The Neuroses of Development*, Edin. 1891, 12.

an indication of general toxæmia than of intra-cranial disease. It is common, for example, in peritonitis, in liver-atrophy, and in all sorts of septic infection, in enteric, in erysipelas, and in severe cases of infective disease of any kind. It is probably most common in pneumonia. The possibility of delirium being caused by atropine or belladonna is not to be forgotten.

Pain.

When *persistent local pain* is complained of by young children, it almost invariably signifies the presence of organic disease; and, if the cause is not obvious, the child must be kept under observation. Pain of this kind must never be regarded as a trivial matter. On the other hand, pain is often absent in young children under circumstances in which we should expect to find it in adults, such as in pleurisy, herpes zoster, and otitis media. We must also remember that young children often complain of pain, when little or none is present, because they have been accustomed to hear their mothers do so; and that they not infrequently deny having pain when they are really suffering, because they do not clearly understand the meaning of what is asked. It is therefore best to found our diagnosis of this symptom more on what we observe of the patient's expression and behaviour than upon his complaints.

A distressed expression, with uneasy working of the mouth and lifting the hand to the jaws or ears, is seen in teething babies. There is also a similar look on the face in acute otitis.

The paroxysms of frightened crying, with flexing of the lower limbs and arms, clenching of the fists and the subsequent passage of flatus, which indicate intestinal colic, have been already alluded to (p. 126). These are readily distinguished from the attacks of screaming and stiffening of the back, with the lower extremities fully extended and pressed together, which are seen in rectal spasm (p. 115). In renal colic also the lower limbs are generally not flexed, and there is often tenderness in one or other loin, or over the distribution of the twelfth dorsal and first lumbar nerves above the groin; the testicle is also tender and retracted, and the breathing quickened.

The characters of acute pleuritic pain have already been described (p. 8). It causes an appearance of great distress because the patient has to restrain his inclination to cry, on account of the pain which every full breath causes. This, with the dilated and working alæ nasi and the rapid and shallow breathing, are quite characteristic. Pain due to disease in one or other *pleura* is sometimes referred by the child to the middle line in front, often to the epigastrium. Occasionally it is felt quite low down on the side of the abdomen, and when on the right side, may be mistaken for that of appendicitis. Another exceedingly distressing and sickening form of pain is the kind of angina which occurs in some cases of congenital heart-disease (p. 476).

Abdominal pain is often, of course, due to digestive disturbance, and it is also frequently caused by spinal caries. Pain in the *thigh* or on the *inner side of the knee* is an early symptom of hip-joint disease; but, in this situation or lower down (even in the foot), it may be due to spinal caries, and it sometimes occurs at a stage when no local abnormality of the spine can be discovered without an X-ray examination.

The shock which severe pain inflicts on a child is so great that it should never be allowed to continue long without relief: prolonged and painful surgical dressings should usually be done under chloroform.

Headache.

In school children headaches are often complained of, and when they are recurrent they leave distinct traces on the *physiognomy*. Dr Francis Warner says, "It is not uncommon to observe that a child looks as if he had a headache. Analysing such faces you may soon observe a look of depression, heaviness, and fullness about the eyes, especially about the under eyelids: this sign is usually bilateral, and is due to a relaxed condition of the muscle (orbicularis) which surrounds the eyelids. If the patient can be made to laugh, the muscle becomes energised, and the expression of headache is lost for the moment. This sign is often best seen in the profile view."[1] In all cases of headache the teeth should be examined for caries. Severe headaches occur in uræmia, malaria, anæmia, and plumbism.

[1] *The Children: How to Study Them*, London, 1885, 51.

One of the commonest forms of headache is that due to *refractive anomalies*, especially slight degrees of hypermetropia and astigmatism; this is rapidly cured by the use of suitable spectacles.

The presence of *adenoid growths* also gives rise to some headache in a large proportion of cases (50 per cent.—Crowley).

Dyspepsia is another common source of headaches. In many cases, whether there is a discoverable local cause or not, the patients are delicate children who are obviously being *overworked at school* and having too little fresh air and exercise.

Migraine sometimes begins in young children as recurrent acetonæmia and is generally accompanied by a rise of temperature. As the child grows older, however, the attacks assume the ordinary afebrile character seen in adults.

Recurrent headaches in children should be treated with salol and soda (p. 462) during the intervals between the attacks, and are sometimes benefited by a combination of liquid extract of ergot (10 to 20 minims) and solution of strychnine (2 to 3 minims) (E. Smith).

In infants headache may be the result of coryza or pyrexia, or of some gastric or hepatic disorder. If severe or persistent —especially if accompanied by vomiting—it is often a sign of meningitis or intra-cranial tumour.

Giddiness.

Vertigo is sometimes found in young children. When in bed or sitting on his mother's knee, the child cries out that he is falling, or that the roof or furniture is moving. This sensation of giddiness may be a symptom of *tuberculous* or of *posterior basic meningitis*. It also occurs sometimes during the onset of various infectious diseases, such as mumps, influenza, and measles. I have also known it recur, off and on, for months, severely in young children with obstinate constipation from *disordered digestion*, and nothing worse. When vertigo is present, the condition of the *ears* must, of course, always be investigated.

Infantile Convulsions.

It is hardly necessary to give a detailed account of a well-marked infantile convulsion, as its phenomena are just those of

an ordinary epileptic seizure. In the worst forms the tonic and clonic movements may be very severe, and the succeeding loss of consciousness profound and long-continued. In other cases, there may be just the slightest momentary unconsciousness and no visible jerking at all. Slight and severe attacks often occur in the same child at different times.

Causation.—Like all nervous disorders which consist in disturbance of function, convulsions have often a multiple causation. That is to say, in order to explain their onset we must take into account not only a combination of several exciting causes, but also a number of predisposing conditions. This point is of some practical importance, because we may sometimes succeed in stopping the recurrence of the convulsions by curing one or more of the causes, even although the others are beyond our treatment. The division into predisposing and exciting causes is convenient, although it must be admitted that it is not always easy to draw the line clearly between the two.

Of *predisposing causes* four may be mentioned: (1) There is, of course, the *age* of the patient—the state of development of the infant's nervous system predisposing him to all kinds of convulsive attacks. (2) Certain general diseases may predispose —especially *spasmophilia* (p. 436). This is by far the most important of the predisposing causes, as it is that which is most amenable to immediate treatment. The tendency to convulsions in this condition almost always disappears rapidly under dietetic and antirachitic treatment, even although obvious sources of peripheral irritation persist. (3) A very important predisposing element is an *inherited nervousness* of constitution. Some children are hereditarily so nervous that any rise of temperature or peripheral irritation, however slight, will bring on a fit. This state of nervousness may be found in children who seem otherwise strong, and sometimes many members of a family have it. (4) Another predisposing condition is a permanently *damaged state of the brain* from any cause—quite apart from any recent changes. An area of cortical sclerosis, for example, even when it does not seriously affect the mental functions, is often accompanied by a tendency to convulsions. In the same way, nearly all the developmental and other lesions which produce imbecility predispose also to convulsions on slight provocation. Their recurrence in young children should,

therefore, always lead to a careful consideration of the child's mental state.

Possible *exciting causes* are very numerous. The most important of them may be classed in one or other of three groups:—(1) *Intra-cranial causes* (diseases, injuries, or circulatory changes).—Such, for example, are concussion, hæmorrhage, tumour, abscess, and meningitis of any kind; also the cerebral congestion which occurs in whooping-cough and in some cases of congenital heart disease, and the cerebral anæmia which accompanies severe diarrhœa and loss of blood. (2) *General acute morbid conditions.*—A sudden rise of temperature, such as would produce a rigor in an adult, will often cause a convulsion in an infant. This is seen in pneumonia and in certain of the exanthemata, especially scarlet fever. In uræmia, fits are not uncommon, and a large number of poisons, both metallic and vegetable, may cause them. (3) *Peripheral nervous irritation* —often of obscure origin. Undigested matters in the bowel or stomach, painful lesions in connection with dentition, otitis, and phimosis readily start convulsions in spasmophilic and neurotic infants.

Diagnosis.—There cannot usually be much difficulty in recognising a convulsion, if you see it. When, however, you have only the mother's description to go by, it may be impossible to be quite sure as to the nature of the "fit." Attacks of petit mal often pass unrecognised for months from the idea that they are merely slight faints. On the other hand, spasms of colic and laryngismus, and also rigors, are sometimes mistaken for fits. On several occasions I have seen cases of masturbation in female infants, who were being carefully nursed and having bromides and sympathy administered under the impression that they were suffering from a distressing variety of infantile convulsions.

Diagnosis of the Cause.—Whenever the urgency of the symptoms has abated, the cause of the attack must be investigated.

1. There is, to begin with, the patient's *age.* Should the attack come on within the first fortnight of life, the likelihood of its being due to a birth injury is to be remembered, though convulsions from dyspepsia and other causes, quite apart from trauma, often begin very soon after birth. To this subject we shall return later. Those convulsions which begin after the

second week are not likely to have anything to do with a birth injury. They may arise from a defective brain, from dyspepsia, and from various other causes. The great majority of fits seen in normally developed babies between six months and two years belong to the spasmophilic class.

2. The *character of the fit* often gives us but little help in the diagnosis, though occasionally it does shed some light on the question. If, for example, the features of the attack are those of petit mal, this generally, although not always, indicates a serious cerebral defect. If the fit is Jacksonian in character, this suggests a cortical lesion. If it is followed by prolonged unconsciousness, an organic cerebral cause becomes probable although not certain. Unilateral or asymmetrical movements do not necessarily, in young children, indicate a unilateral organic cause.

3. The presence of *symptoms of any bodily disease* that is known sometimes to cause fits is, of course, of great importance. Thus, fever with rapid respiration or a sore throat may point to pneumonia or scarlet fever. A bulging fontanelle, head retraction, or paralysis, with a history of previous vomiting and headache, would suggest meningitis; while abdominal distension and malnutrition, along with other dyspeptic symptoms, would naturally point to there being some connection with the alimentary canal.

Prognosis.—When mental defect is present after a series of convulsions, it is generally probable that it existed before, and that it should be looked upon rather as the cause than as a result of the fits. Certainly, however, in some cases the intense cerebral congestion and excitement accompanying the seizure seriously injure the brain tissue, either by causing hæmorrhage or otherwise. The recurrence of convulsions is accordingly often followed by steadily increasing dementia, even in cases in which no naked-eye change is afterwards discoverable. Occasionally, although rarely, the attack may be fatal. This probably occurs most frequently in cases of spasmophilia in which the fits are complicated by laryngismus. These considerations emphasise the importance of using active measures to stop the attacks as soon as possible. In many cases, also, temporary damage is done, and one or other cerebral function may remain in abeyance for some weeks, or months, after a severe convulsive attack. Thus, passing hemiplegia, or aphasia, or

blindness may be due to temporary exhaustion produced in certain areas by the nerve storm. Similarly, a condition of extreme intellectual dullness occasionally results, which is entirely recovered from, even though it has lasted for weeks.

Treatment of the Attack.—If the convulsion lasts long enough to allow time for treatment, it is generally advisable to begin by putting the child into a mustard pack or hot bath. It will probably be good for him, and it will certainly soothe and relieve his alarmed relatives, who generally need something to do to take up their attention.

If the convulsive movements continue for more than a few minutes, or if they go on recurring at short intervals, more active sedative measures are called for. Chloroform inhalation is one of the best of these, and it is quite safe and often successful. Chloral hydrate is also very effectual, and its influence lasts longer than that of chloroform. If the child cannot swallow, it may be given hypodermically (2 or 3 grs.), or introduced into the bowel through a rubber catheter. For rectal injection, 5 grs. is the dose for a baby of six months, and 10 grs. for one of a year old. In severe cases, the most effectual treatment of all is the hypodermic injection of morphine. Of this, $\frac{1}{24}$ gr. may be given to a well-grown baby of a year, and the dose may be repeated in half an hour if no effect is produced. Morphine should not be given to weakly or undergrown babies.

The treatment of convulsions, however, is less important than the prevention of their recurrence. As this depends mainly on the type of case present, we shall consider briefly a few of the commoner types of infantile convulsions.

Some Common Types of Convulsion Cases.

1. **From Birth Injury.**—If convulsions set in in a new-born baby within the first week or so of life, it is natural to suspect that they may be due to intra-cranial hæmorrhage or other birth injury. This suspicion is greatly strengthened if the labour was premature or difficult, and especially if the child had fits or difficulty in breathing after birth. If the fontanelle is tense and bulging, this is a strong point in favour of a diagnosis of hæmorrhage; and this is confirmed if blood is found in the cerebro-spinal fluid on lumbar puncture.

The *treatment* should generally be purely expectant. The infant is to be kept quiet and warm, and everything possible done to favour his nutrition. Sedatives are not usually called for. Cushing has recommended[1] opening the cranium in these cases. While this suggestion is interesting, its advisability in most cases cannot be said, as yet, to have been established.

The *prognosis* must always be guarded. It is probable that many of the children who have traumatic cerebral hæmorrhages at birth recover completely; but certainly many of those who seem to get quite well show symptoms of paralysis, epilepsy, or mental defect, in later childhood.

2. **From Dyspepsia.**—In many infants who have convulsions, the attacks are clearly due to dyspepsia. Whether they arise reflexly from local irritation in the bowel, or are caused by auto-intoxication, need not be discussed here. In these cases the fits may begin soon after birth, or indeed at any time during infancy.

The main *treatment* consists in thorough regulation of the diet, along with the judicious use of calomel, antacids, and stomach-washing, and, when possible, a wet-nurse should be obtained. Generally, no sedatives are required; but a few doses of chloral may be useful at first.

The *prognosis* depends on the progress of the dyspepsia. There is no likelihood that the brain will be seriously or permanently damaged.

3. **Idiopathic Convulsions.**—The next group of cases may, in the meantime, be conveniently called "idiopathic convulsions," because no central, peripheral or other cause has as yet been proved to account for their occurrence.

The patients are mostly boys, either breast or bottle-fed, and they have shown no previous sign of disease. The attacks, which may be unilateral, often begin as early as the first week and generally within the first few months. The convulsions are at first slight in character and of short duration; and only two or three may occur in the day. They usually, however, increase rapidly in number till there are as many as twenty or even forty in the twenty-four hours; and, if the case is not efficiently treated, this number may continue for weeks or months.

[1] *Amer. Journ. of Med. Sci.*, 1905, cxxx., 563.

Bromides have little if any effect, and, to try alterations of diet when none are indicated, is merely to lose time. It is *very important* to get the infant thoroughly under the influence of chloral as soon as possible; and it can easily be given by the mouth. In the youngest babies, 1 gr. every two hours, and in children of one or two months, 1½ or even 2 grs. is not too large a dose. These doses should be continued until the fits have ceased for at least twenty-four or thirty-six hours, and then gradually diminished in frequency. If the first dose given is not enough, the amount must be cautiously increased until the baby is *almost* too drowsy to swallow. The greatest care must, however, be given to the feeding if the child is very drowsy, as otherwise there is a considerable risk of an inhalation pneumonia being set up. Usually we find that, after the chloral has been given for three or four days at most, the fits cease to return when it is stopped, and the child remains quite well. If the chloral is not continued long enough, the fits return when it is stopped.

The usual completeness and permanence of the recovery of these cases after a short course of chloral are very striking. They are probably to be explained by the hypothesis that the drug prevents, for the time being, the toxic action of some absorbed protein on the nervous system, and so gives the child's tissues a chance of becoming immunised to it (see Appendix C).

The *prognosis* is generally favourable. A large majority of the cases recover completely and, although some of the babies may remain drowsy and stupid for weeks after the fits have ceased (Fig. 154), it is very rare for any permanent injury to be done to the brain. It must, however, be guarded, partly because babies at this age are so feeble that intercurrent affections are to be feared, and, partly because, in some rare instances, if the fits have been allowed to continue for a long time unchecked, the brain-cells undergo atrophy and idiocy results. Another reason for a guarded prognosis is the difficulty of being quite sure of the diagnosis. I have seen two cases in which convulsions, apparently of this nature, ushered in an acute miliary tuberculosis in infants of four and a half and six weeks respectively.

4. **From Spasmophilia.**—The commonest kind of convulsions met with in a city practice in this country are those which occur about the age of teething, as a symptom of spasmophilia. In

these the predisposing cause is all-important; for if the underlying constitutional abnormality is energetically treated, the morbid sensitiveness to peripheral irritation rapidly ceases, and there are no more fits, even although no sedative drugs have been given.

The age for this variety of convulsions is between six months and two years; and they are commoner during the spring months, when cold winds are blowing, than at any other time of year. The rickets, which is practically always present, is generally in an early and progressive stage. The diagnosis depends on the absence of other obvious causes of convulsions, the presence of rickets, and especially on the recognition of other manifestations of spasmophilia, such as the characteristic electrical and mechanical irritability of the peripheral nerves, laryngismus, and tetany, or on a history of such symptoms having previously occurred.

Prompt *treatment* of the spasmophilia leads, almost always, to most satisfactory results. The digestion and bowels must, of course, be seen to, and the diet regulated on antirachitic lines. Cod-liver oil, with or without phosphorus, should also be given; and it is of great importance to see that the child has plenty of fresh air. It is well also to institute a regular cold douche once or twice a day; this has a powerfully soothing effect. Under such a regimen the baby's health usually improves rapidly, and the convulsions cease almost at once. Should they be numerous, however, or very severe, it may be well, during the first day or two, to give a few doses of antipyrine (1 or 2 grs.), or chloral (2 to 3 grs.).

5. **From Congenital Cerebral Defect.**—In many cases the occurrence of convulsions in an infant is the first, and it may be, as yet, the only sign of idiocy. Generally, the seizures, in these circumstances, take the form of petit mal to begin with. The baby is seen from time to time to give a sudden jerk forwards of his head and shoulders. After this, he may be unconscious for a few minutes or less, with heavy breathing, and he often cries bitterly. As he gets older his "turns" become more obviously epileptiform in character, and usually develop into ordinary convulsions.

The occurrence of such attacks is a bad omen for the child's future. They tell of a serious defect of the brain, and their frequent recurrence is always followed by further mental

deterioration. The character of the fits, and the usual signs of mental backwardness, soon render the diagnosis easy.

The results of *treatment* are most disappointing. Sedatives have only a slight and temporary effect. If they are pushed, they upset the digestion and do more harm than good. Frequent changes to the country, and at times the administration of iron or some other tonic, form generally the best treatment. In a very few cases the administration of thyroid does good for a time.

6. **From Congenital Syphilis.**—There is another variety of fits, indicating severe structural disease of the brain, which is sometimes met with in syphilitic babies of a few months old.[1] In these cases the convulsive movements, which are often very slight, are generally one-sided to begin with, or there may be only a series of twitchings of one arm or leg. They may be accompanied by a momentary loss of consciousness or only by a dazed look. Later, twitchings appear on the other side of the body, and the limbs first affected become flexed and contractured. The child's intelligence generally deteriorates.

The cortical lesion which gives rise to these symptoms consists in a patchy softening of the grey matter with degeneration of the arteries, and it ends in sclerosis. The resulting dementia is severe in degree and permanent (p. 752). Treatment seems to have no effect.

State of the Pupils.

The size of the child's pupils and also the range of their reaction to light are relatively small during the early weeks of life, but they increase steadily after the first month.[2]

Contracted pupils are seen normally in sleep, and they are met with during waking in the early stage of meningitis and in opium narcosis.

Widely dilated pupils, responding little or not at all to the action of light, occur in the later stages of most serious cerebral diseases, and also in "hydrocephaloid." Marked inequality of

[1] Ashby, "On Convulsions during Infancy and Childhood," *Lancet*, 21st Jan. 1905, 136.

[2] H. Pfister, "Ueber das Verhalten der Pupille und einiger Reflexe am Auge im Säuglings- und frühen Kindesalter," *Archiv für Kinderheilk.*, 1899, xxvi., 11.

the pupils is observed in serious cerebral disease and also in cases of affection of the sympathetic in the neck.

Rhythmical contraction and dilatation of the pupils (hippus) is observed occasionally under a variety of circumstances. It is not uncommon in cases of spasmus nutans.

Strabismus.

The term "squint" is commonly applied to any deviation observed in a child's eyes. Such deviations are met with as the result of three distinct conditions :—

1. *Simple disturbance of co-ordination* of the ocular movements. This is not real strabismus. It is often normally present in young babies, and in them may occur in a severe degree in any case of high fever, quite apart from head mischief, as well as in cases of meningitis and other intra-cranial disease.

FIG. 155.—Tumour of Medulla, involving nuclei of 6th and 7th nerves. Girl of 2 years.[1]

2. *Ordinary concomitant strabismus* occurs commonly in children as a result of hypermetropia. It may appear for the first time after a convulsion or during an attack of spasmus nutans, and it sometimes seems to be due to cerebral injury at birth.

3. *Paralytic strabismus* is most frequently seen as a symptom of tuberculous meningitis. Sometimes it is due to a cerebral tumour (Fig. 155). Occasionally it is caused by diphtheritic paralysis, in which case it is generally slight in degree and reveals itself mainly by the diplopia which it occasions. I have seen transitory paralysis of the external rectus under other conditions, *e.g.*, once in the course of croupous pneumonia and once during an obscure feverish attack which was possibly influenzal.

[1] *Trans. Med. Chir. Soc.*, Edin., 1891, x., 210.

Nystagmus.

We may divide oscillating movements of the eyeballs into "nystagmoid movements" and "nystagmus proper." The former term may be used to describe such aimless shaking of the eyes as is seen in some idiots, and the rhythmical twitching which occurs when a patient with conjugate deviation tries to look straight forward and his eyes automatically jerk back to their former position.

Nystagmus proper in childhood includes two conditions—"ordinary nystagmus" and "the nystagmus of spasmus nutans." These differ widely from one another in causation, significance, and prognosis.

Ordinary nystagmus either dates from the earliest infancy or is acquired later. In the former case it is generally due to some local condition which has interfered with the infant's sight at the time when he should have been learning, by the aid of vision, to keep his eyes steady. It has to do with the deviating movements of the eyes which are present from birth. We find it in cases of corneal opacity from ophthalmia neonatorum, in congenital or very early cataract, in early irido-choroiditis in coloboma, and in albinism. Not very rarely no cause can be discovered.

The acquired variety has generally some central cause. It occurs, for example, in some cases of meningitis, hydrocephalus and epidemic stupor, in some of porencephaly and congenital spastic diplegia, in Friedreich's ataxia, and occasionally in intracranial tumours. In many cases, however, no local or general cause can be found.

The peculiar **nystagmus of spasmus nutans** is a co-ordination-neurosis and has to do with the acquired movement of convergence. It differs from the ordinary kind not only in its being usually (though not always) associated with head movements, but also in the following particulars:[1]—

(*a*) *Its Time of Onset.* — It is always acquired—setting in, generally, between the ages of six and twelve months while the baby is engaged in learning to control his ocular movements. I have never known it to occur except in early childhood.

(*b*) *Its Tendency to Recovery.*—It is always recovered from

[1] Thomson, *Brit. Med. Journ.*, 30th March 1901, i., 763.

within a few weeks or months. Ordinary conjugate nystagmus is generally permanent.

(*c*) *The Character of the Movements.*—Ordinary nystagmus is nearly always bilateral and horizontal. This form is often unilateral, often vertical or rotatory, and not rarely it shows different directions of movement in the two eyes—*e.g.*, horizontal or vertical in one, and rotatory in the other.

Ordinary horizontal nystagmus is *always* conjugate—the antero-posterior axes of the two eyes remaining parallel to one another all the time. The nystagmus of spasmus nutans, when bilateral and horizontal, is usually convergent—that is to say, the corneæ incline alternately towards and away from one another. Rarely it also is distinctly conjugate. In some cases the nystagmus is so fine that it is almost or quite impossible to make sure of its type.

In those cases of spasmus nutans in which the nystagmus is rotatory, the movement is not a simple rotation of the globe round its antero-posterior axis, but a sort of irregular circumduction—the central point of the cornea passing through an ellipse or some such rounded figure.

Although this variety of nystagmus is not important in itself, it is well that it should be clearly distinguished from the ordinary conjugate variety, because of the entirely different significance of the two phenomena and their different prognosis.

The Fundus Oculi.

In cases of doubtful syphilis, the fundus should always be examined for patches of choroidal atrophy. Tubercles are sometimes found in the choroid in tuberculous meningitis, but oftener in general tuberculosis.

Optic neuritis occurs in many conditions besides cerebral tumour and other gross intra-cranial lesions. It is often to be found in the later stages of tuberculous meningitis, but is very rare in the meningococcal form of the disease.

Cervical Opisthotonos.

Head retraction with rigidity of the neck generally indicates the presence of meningitis. When it occurs in the tuberculous form, it is often slight and intermittent; but in meningococcal and other septic varieties, in which it is almost always present;

it is usually an early symptom, is very severe, and persists till death, or, in cases which recover, for many weeks. Cervical rigidity is also found in chronic hydrocephalus (Fig. 156), in cerebral tumour, and in many cases of poliomyelitis.

FIG. 156.—Chronic Hydrocephalus following Meningitis, showing head retraction. Girl of 1 year.

Although head retraction when severe in degree is usually a symptom of intra-cranial disease, it is sometimes met with under other conditions. We find it in acute otitis media, in tetanus, and in typhoid, diphtheria, and pneumonia, without any brain lesion. Not very rarely it occurs in wasted babies with dyspepsia,[1] and a minor degree of it is sometimes seen in tetany.

Various surgical affections, such as acute retropharyngeal adenitis or abscess, and cervical caries, cause stiffness of the neck with drawing back of the head, which may be mistaken for cervical opisthotonos of intra-cranial origin.

The Superficial Reflexes.

In early childhood the skin reflexes are generally poorly marked and they are never exaggerated. In young babies some of them, such as the abdominal, are often absent altogether. Sometimes, however, as R. Laurent has pointed out,[2] during the first nine months the area, stimulation of which elicits the abdominal reflex, is considerably enlarged. This is never found after the fourteenth month. The cremasteric reflex is often absent in young children.

[1] Beattie and Selby, *Edin. Hosp. Rep.*, 1896, iv., 343.

[2] "Evolution des Réflexes chez l'Enfant," *Thèse de Toulouse*, 1905.

The Plantar Reflex.

As Babinski stated in his first paper on this subject, an extensor response is normally present in new-born children. This is not, however, the only peculiarity of the plantar reflex in infancy. The effect of stimulating the sole in a young baby has been described as follows by James Collier:[1] "The earliest response is in the great toe, which is drawn back. This is followed by extension and spreading out of all the toes with eversion of the foot and dorsiflexion of the ankle, and subsequently flexion of the hip and knee. Strong stimulation causes a general irregular movement of the limbs and trunk." This "infantile response" "contrasts most markedly with the adult form, with the contracted flexed toes, inverted foot, and the early hip response."

As the child grows older, the preponderance of dorsal over plantar flexion steadily diminishes, until by the end of the first year the proportion of each is about 50 per cent. of the whole.[2] During the second year plantar flexion becomes increasingly common. About this age, however, the reflex is often not easily obtainable. By the third year, a flexor response is practically always present in healthy children.

Although the transition from dorsal to plantar flexion normally occurs about the time when the child is learning to walk, it does not seem to be due to this; for plantar flexion is found in many children who cannot walk, and is delayed in some who do. In weakly, backward children, the appearance of the normal flexor response is apt to be delayed, while in strong, vigorous infants, it appears sooner than usual.[3]

During sleep the plantar reflex is less definite, but generally its type is the same as when the child is awake. Occasionally, however, children are met with, even as old as twelve, who present a typical infantile response during deep sleep, although at other times they show the ordinary plantar flexion. The same thing may sometimes be noticed during chloroform narcosis and immediately after an epileptic seizure.

In older children the significance of changes in the plantar reflex is the same as in adults. In infants under two, Babinski's

[1] *Brain*, Spring 1899, 78.
[2] Engstler, *Wien. klin. Wochenschr.*, 1st June 1905, 567.
[3] Passini, *Wien. klin. Wochenschr.*, 1900, No. 41.

symptom has generally no value as a sign of disease. If, however, a flexor response is obtained in premature and ill-developed infants who are late of walking, it is a good omen.[1] It indicates that the cord is healthy and therefore justifies the hope that the children will ultimately be able to walk.

The Lip Reflex of New-born Children.[2]

When we consider that the act of sucking is the most fully developed voluntary co-ordinated act of which the newly born child is capable, it is not surprising that the lips should be the seat of a special reflex at birth. It is probable that the lip reflex serves a useful purpose in assisting the infant's first unpractised attempts at sucking. By its means the mouth assumes automatically a more convenient shape for receiving and retaining the nipple. In the same way the mother's nipple, when subjected to mechanical stimulation, contracts so as to become thinner, longer, and harder, and therefore more easily grasped and retained by the infant's mouth.

The reflex is best elicited by a series of gentle taps on the upper lip a little above the angle of the mouth, or on the under lip a little below it (Figs. 157 to 159). It can, however, be got by tapping anywhere on the lips in a well-marked case, and sometimes over a considerable part of the cheek. A gentle touch on the mucous membrane of the lips, such as might be given by the mother's nipple, will also originate some degree of the movements.

On tapping the upper lip there is often, first of all, a slight momentary jerk. This is generally towards the side tapped, but sometimes towards the other side. Almost at the same time the lips close, if they have been parted, and become deliberately pursed together so as to pout a little. As the tapping is repeated, the protrusion of the mouth becomes more and more definite (Fig. 159). In some instances the projection is straight forward, but generally the central point of the mouth turns distinctly towards the side *opposite* to that tapped. Both

[1] Léri, *Revue neurolog.*, 30th July 1903, 689.

[2] See Escherich, *Traité des Maladies de l'Enfance* (*Comby et Grancher*), Paris, 1898, iv., 755 ; Loos, *Verhandl. d. Gesellsch. f. Kinderheilk.* (*Frankfurt-a.-M.*, 1896), Wiesbaden, 1897, 1 ; Thomson, *Rev. of Neurol. and Psychiatry*, March 1903, i., 145 ; Toulouse and Vulpas, *Comptes rendus hebdominaires des séances de la Société de Biologie*, Séance du 11 Juillet, 1903, lv., 152.

FIG. 157.—Before tapping.

FIG. 158.—After first tap.

FIG. 159.—After several taps.

upper and lower lips participate in the pouting. In some cases the preliminary jerk is not seen. In others, after repeated tapping, there are to-and-fro sucking movements of the tongue along with the pouting. When the lower lip is tapped, the resulting phenomenon is much the same.

The lip reflex seems to occur more or less distinctly in all healthy new-born babies when they are sound asleep, and in a considerable proportion of them when they are sleeping lightly, or even are only drowsy. I have seen it in a few new-born infants who were evidently wide awake; but this is rare.

As the children grow older, the reflex is less frequently found, and is only present when they are sound asleep. Until the end of the third or fourth year, it is fairly common. After that it is less so, and it is usually also less vigorous. I have found it occasionally in older children up to twelve years, but have not examined for it in adolescents or adults. The lip reflex must not be confused with "facial irritability" (Chvostek's phenomenon) (p. 437).

Infants of a few months who are taking large doses of chloral on account of repeated convulsions often show a peculiarly strong lip reflex. Probably this may be due partly to their being able to stand more percussion than usual without waking. I have, however, seen it strongly present in several babies who were taking convulsions and who had not had any sedative drugs.

Some cases of spastic diplegia show energetic chewing, sucking, and swallowing movements when touched on the lips and other neighbouring parts. This phenomenon seems to represent an exaggeration in the degree and extent of the normal lip reflex.[1]

Myotatic Irritability.

A high degree of myotatic irritability is often found in children, and occurs very often in cases in which there is no tuberculous disease.

State of the Knee Jerks.

To obtain the knee jerks in a young child, while he is sitting on his mother's knee, it is best to place the palm of the

[1] H. Oppenheim, *Monatsschr. f. Psychiat. u. Neurol.*, 1903, xiv., H. 4, 241.

left hand under his foot, and to support his leg in this way as by a stirrup; then, on tapping gently on the tendon with the middle finger of the right hand or, even better, with a percussion hammer, the amount of movement which takes place is readily felt as well as seen. In strong, healthy children the knee jerk is generally easily obtained. In those with weak and flabby muscles it may be difficult to make sure of its presence. When there is difficulty in eliciting the knee jerk in the ordinary way, it may sometimes be got by gentle tapping with the limb considerably extended.

In childhood the knee jerks are generally brisk. In healthy infants under six months this is especially the case; though it may sometimes be difficult to elicit them owing to the child's restlessness. Considerable increase of the knee jerks may be present in nervous children apart from any organic disease.

They are nearly always absent in diphtheritic paralysis, in peripheral neuritis, in progressive muscular atrophy and pseudo-hypertrophic paralysis, in those cases of infantile spinal paralysis in which the extensors of the thigh are affected, and in various other conditions. The knee jerks are said to be absent in a large proportion of cases of croupous pneumonia in children (Pfaundler,[1] 27·5 per cent.; Kephallinós,[2] 41·5 per cent.). This may be of value in diagnosis, as loss of the knee jerks is rarely found in other acute feverish conditions except neuritis and poliomyelitis.

The knee jerks are increased in most cases of infantile cerebral paralysis (though, in some, the extremely spastic condition of all the muscles renders the movements even less than normal); also in myelitis and pressure on the cord above the lumbar region, and in many other forms of organic disease of the brain and spinal cord. They are also exaggerated, though to a less extent, in children who have suffered from a prolonged feverish illness such as enteric fever. They may be increased to a considerable degree also in severe and long-standing hysteria.

Kernig's Sign.

This consists in a reflex contraction of the hamstring muscles which occurs whenever an attempt is made to ex-

[1] *Münch. med. Wochensch.*, 1902, xlix., No. 29, 1211.
[2] *Ibid.*, 24th July 1906, 1460.

tend the knee joint while the thigh is kept at right angles to the trunk. It can be elicited, either when the patient is sitting on the edge of the bed, or when he is lying on his back.

When other symptoms of meningitis are present, the discovery of Kernig's sign affords fairly strong confirmation of the presence of that disease. The importance of the sign in clinical work is, however, difficult to estimate. It is commonly present in cases of cerebro-spinal meningitis, though in some typical cases it is absent throughout. It is not rare in tuberculous meningitis, although less common in it than in the non-tuberculous variety. It may also be found in a variety of conditions in which the meninges are not inflamed; for example, in intra-cranial hæmorrhage and abscess, in acute poliomyelitis, in some cases of pneumonia, uræmia, typhoid fever and other intestinal diseases with nervous symptoms (meningism).

In young infants, owing to the tendency to hypertonicity of their muscles, Kernig's sign often cannot be satisfactorily demonstrated.

Brudzinski's Neck Sign.[1]

To elicit this sign, the child is laid flat on his back and his head is rapidly bent forward by the observer's left hand, which is placed on the occiput, the chest being held down by the right hand. In the great majority of cases of meningitis, a marked flexion of the lower limbs at the knee and hip-joints occurs when the head is brought forward. This sign is said never to occur in healthy children or in those who are suffering from other than meningeal disease. It occurs with equal frequency in all varieties of meningitis.

Tache Cérébrale.

This symptom—the unusual persistence of marked hyperæmia in the track of a light scratch on the skin—used to be thought pathognomonic of meningitis. It is common in the later stages of severe cerebral cases, but is of little diagnostic value, as it may occur in enteric and other fevers without any brain lesion being present.

[1] Brudzinski, *Archives de Méd. des Enf.*, 1909, xii., 745; Morse, *Trans. Amer. Ped. Soc.*, 1910, xxii., 50; Northrup, *Journ. Amer. Med. Assoc.*, 14th Jan. 1911, lvi., 114.

Paralysis.

In investigating any apparent loss of muscular power in a child, we have, *first*, to decide whether it is a true paralysis, or merely a pseudo-paralysis resulting from pain on movement, from extreme flabbiness of the muscular tissue, or from some malformation; and *second*, if a true paralysis, whether the lesion is in the brain, cord, or peripheral structures, or is a so-called functional palsy such as may be met with in hysteria, or as the result of peripheral irritation.

Pseudo-Paralysis.

Disinclination to move the limbs, owing to the pain which movement causes, is seen in cases of *disease* or *injury* of the muscles, ligaments, and bones. If present in the upper arm soon after birth, it may be due to injury of the upper epiphysis of the humerus during delivery. In syphilitic infants between four and twelve weeks old it is generally caused by *specific epiphysitis*, and most frequently affects the upper limbs (p. 750). A somewhat similar pseudo-paralysis occurs in cases of *infantile scurvy*. This, however, is oftenest met with in children between eight and fourteen months old, and affects the lower more often than the upper extremities. It must be remembered that true paralysis (as from anterior poliomyelitis or peripheral neuritis) is frequently accompanied at first by severe pain on movement.

The pseudo-paralysis seen in *rickets* seems to be due more to muscular debility and laxity of the ligaments than to tenderness of the structures, although that has probably some share in producing it. While it may be noticed during any stage of rickets, it rarely causes difficulty of diagnosis except late in the course of the disease, when the characteristically rickety symptoms have more or less subsided. It is always symmetrical, and is generally noticed in the lower limbs, although the upper limbs if examined will be found similarly affected.

The weakness caused by *congenital dislocation of the hip joint*, and by various other congenital malformations of the limbs, is apt to be attributed to infantile paralysis.

Diagnosis of Paralysis.—In endeavouring to ascertain the cause of a local or general paralysis in a child, we have to inquire as to the nature of its onset and the symptoms which preceded and accompanied it, and to examine the parts affected as to tenderness to touch and on movement, sensibility of various kinds, active and passive mobility, the state of the reflexes and the electrical reactions. We have also to remember which diseases are likely to occur at the age of the patient.

Paralysis which is present at birth may be the result of intra-uterine disease or arrest of development. Generally, however, it is caused by some injury sustained during the progress of the labour. Cases arising in this way have sometimes been spoken of as "obstetrical paralyses," but it is better to call them *birth palsies* (Gowers[1]).

Tremor.

Tremor is rather a rare symptom in young children. A general coarse tremor is sometimes met with in certain forms of infectious disease such as enteric fever and influenza, and in tuberculous meningitis. Local tremor of a limb is seen in some cases of cerebral and cerebellar tumour.

Ataxia.

Defective co-ordination is such a characteristic feature in the movements of healthy infancy that slighter degrees of morbid ataxia are apt at first to be overlooked. A transient form of ataxia is sometimes seen in children with a normal nervous system who have been confined to bed for some weeks, with any acute feverish disease such as scarlet fever, and also in those who have been kept lying constantly for months owing to spinal caries. Generally, however, ataxia is a symptom of more or less grave significance. It is characteristic of such conditions as tumours of the cerebellum and mid-brain, of Friedreich's disease, of chorea, of some cases of diphtheritic paralysis, and of certain rare cases of hysteria.

Three varieties of cerebellar diplegia in children, of which the main symptom is ataxia,[2] have been described. These are:

[1] "On Birth Palsies," *Lancet*, 1888, i., 709.

[2] F. E. Batten, "Ataxia in Childhood," *Brain*, Autumn and Winter No., 1905, cxi. and cxii., 484.

(*a*) *Congenital Cerebellar Ataxia—i.e.*, congenital ataxia in mentally normal children, with practically no other indication of intra-cranial disease; this has a tendency to steady improvement, and sometimes almost complete recovery occurs in the course of development. (*b*) *Acute Ataxia* (encephalitis cerebelli)—these cases develop suddenly in healthy children with acute symptoms. They tend to improve, and frequently recover. Most of these cases set in after one of the infectious diseases. When recovery takes place, it may be complete in one, two, three, or more months (Griffith).[1] (*c*) *Progressive Cerebellar Ataxia*—this develops slowly in previously healthy children and has a tendency to progressive increase.

Sensory Defects.

Defects of ordinary sensibility are less frequently met with in children than in adults; and, unless very decided, they are difficult to estimate. General tenderness to touch and movement usually arises from the presence of some such general disease as rickets or scurvy, of a local affection of the part, or, less frequently, from lesions of the nervous system, such as basic meningitis or acute poliomyelitis. Local areas of tenderness of the skin or subcutaneous tissue are not common in children, but, when present, they are often useful in drawing attention to the presence and situation of visceral disease.

Electrical Reactions.

When it is important to ascertain the electrical reactions in a young child, it is generally best to administer chloroform, as otherwise the child's struggles will make a proper examination exceedingly difficult, and often impossible.

Lumbar Puncture.

This is a simple proceeding; it does not usually, in young children, require an anæsthetic; and, with ordinary aseptic precautions, it is quite safe. The child is laid on his side with his back bent forward as much as possible. A line drawn across the spine at the level of the upper border of

[1] "Acute Cerebellar Ataxia in Children," *Amer. Journ. of Med. Sci.*, Jan. 1916, cli., 24.

the iliac crests will then be found to pass over the fourth lumbar spine. Just below it, in the fourth space, is the best site for the puncture. An ordinary exploring needle or fine trocar is passed into the interspace in the middle line, to the depth (in a child) of $1\frac{3}{4}$ to 3 cm. Not more than half an ounce or an ounce should be removed, even when the fluid is plentiful, except in special chronic cases. Should the fluid not flow easily, as if from obstruction, a stilette may be passed, but suction by means of a syringe, or otherwise, should not be employed. After the puncture the patient should always, if possible, be kept lying for twenty-four or forty-eight hours.

The cerebro-spinal fluid, in health, is clear and colourless, and under normal circumstances it comes through the needle slowly, drop by drop. In pathological conditions the fluid is often turbid, and its internal tension is sometimes so great that it spurts out. The amount of the fluid and its tension are usually increased in meningitis of any kind, in intra-cranial tumours, in uræmia, and in some cases of hydrocephalus.

The cellular content of the centrifuged deposit of the cerebro-spinal fluid is always important. Normally very few cells are found. In cases of acute meningitis the number is greatly increased. Should lymphocytes predominate, this is in favour of a tuberculous process; while a polymorphonuclear leucocytosis is more characteristic of meningitis due to the meningococcus, or to one or other of the ordinary pyogenic organisms. In the more chronic cases of non-tuberculous meningitis, and during convalescence in the acute cases, a lymphocytosis of the fluid may occasionally be found. Lymphocytosis of the cerebro-spinal fluid is also found in congenital, as in acquired, syphilis.

In tuberculous meningitis, the tubercle bacilli in the cerebro-spinal fluid are generally few in number and hard to find. They should be carefully examined for in the clot which forms in the fluid when it is set aside in a test tube. In the early days of cerebro-spinal and pneumococcal meningitis, the characteristic organisms are usually easy of demonstration.

As a form of treatment, lumbar puncture has proved disappointing. Generally the relief of tension afforded by it (*e.g.*, in tuberculous meningitis) leads to no corresponding

improvement in the symptoms. Occasionally, however, striking relief follows in acute cases. It has also proved useful in convulsions, in uræmic and other forms of severe headache, in some cases of vertigo, in some of head-retraction without meningitis, and in certain forms of chronic hydrocephalus. When hydrocephalus in infancy is accompanied by convulsions and by screaming attacks, these may often be stopped by periodic withdrawal of a small quantity of cerebro-spinal fluid.

CHAPTER XXVIII

ON SOME FUNCTIONAL NERVOUS DISORDERS

On the Disorders of Sleep.

THE characters of normal sleep and its great importance for the child's health have been already discussed (Chapter III.). We have now to consider how these characters may be changed in sickness, and the effect on the general health which scanty or otherwise abnormal sleep is apt to cause. A child sometimes sleeps too much; far oftener, not long enough. His sleep may also be disturbed and lacking in the peacefulness which should characterise it in health; and at times it may be interrupted by nightmare or night-terrors.

Excessive Sleepiness may arise from functional disturbance or organic disease of the stomach, bowel, or liver, or from the action of drugs; but, in most cases in which it occurs to an extreme degree, it is a symptom of intracranial disease (see Drowsiness, p. 536).

Sleeplessness.—In children as in adults, sleeplessness may depend either (*a*) on bodily or (*b*) on mental causes.

(*a*) *Bodily Causes.*—In young infants wakefulness most commonly indicates either hunger, thirst, or indigestion, and calls for a careful revision of the feeding. Occasionally it is due to cold from inadequate coverings. Disturbed sleep is, moreover, a common manifestation of many morbid conditions. It is, for example, characteristic of rickets and congenital syphilis, of coryza, constipation, phimosis, and other ailments that give rise to discomfort, of eczema and other sources of itching, of otitis media, difficult dentition and other painful affections. It is also often seen in pneumonia and toxæmia of various other kinds. Defective ventilation is another common cause; many babies who are wakeful in bed, sleep soundly in

their perambulators in the open air; and a widely open window in the sick room often proves an excellent soporific. Sleeplessness is also due, at times, to the child being put to bed in a brightly lighted room with adults talking beside him.

In older children, sleep is frequently disturbed as the result of indigestion and late meals, and of such local causes of discomfort as adenoids and cold feet. Difficulty in falling asleep at night is often a sign that the school work is proving too much for the child's strength. Occasionally the sleep is disturbed on account of a constantly recurring cough.

(*b*) *Mental Causes.*—It must be remembered that, even in young infants, habitual wakefulness may be largely a matter of bad training and excitement. Not infrequently a troublesome baby, in charge of a restless and vivacious woman, will become a good sleeper soon after he is taken over by a stolid, restful nurse.

In little children, going to sleep, like going to stool and other good habits, is largely assisted by suggestion. When in the quiet routine of the nursery his bed-time comes, drowsiness is unconsciously suggested to the baby as he sees his cot ready and preparations being made for the night. He sees that those round him expect him to go off to sleep and he soon acquiesces. His mother's cradle-song, and the common (though unnecessary and undesirable) habit of rocking, probably owe much of their efficacy to this sort of suggestion.

In those children, however, who are neurotic or have been spoiled, this natural process is easily upset by an attack of temper or some undue excitement, as well as by bodily causes. When this occurs, it may be very difficult to restore the baby's equanimity. Scolding and petting are of no use and usually make matters worse. They fix the child's attention still more on himself, and on succeeding nights he is sure to remember the conflict, and will probably renew it. For, though the struggle was in itself unpleasant, it was accompanied by the gratifying feeling of having aroused a great sensation among his seniors.

In cases of this kind, the recovery of the natural inclination to go to sleep depends largely on how far the mother and nurse are able to supply the necessary suggestion; in other words, to make the baby feel that he is expected to go to sleep, and that no fuss at all will be made if he is long about it.

Occasionally, sleeplessness in children of two years or over is due to the presence of morbid fears which are apt to be aggravated by the dark. Owing to a child's reserve, the cause in such cases may be very difficult to discover and to remove.

In older children, sleep is often disturbed by an undue amount of mental exertion or emotional excitement shortly before going to bed.

The main thing in the management of sleeplessness is the discovery and treatment of its cause. When it is due to pain in acute disease, as at the onset of croupous pneumonia or pleurisy in a strong child, an opiate such as Dover's powder may be beneficial. If it occurs under conditions of exhaustion, it is to be treated by warmth and stimulants. If there is abdominal uneasiness, a large poultice may be the best thing, or an enema of hot water, or a dose of castor-oil. Antipyrine is useful when the sleeplessness is due to itching, and in the temporary restlessness of an acute feverish illness. In habitual wakefulness, however, whatever its cause, drug treatment is almost always bad treatment. The symptom is a danger-signal, and its cause, whether it consists in bad training, in bad habits of life, or in the persistence of some local irritation, must be found out and removed.

Nightmare and Night-Terrors (*Pavor Nocturnus*).—These are commonly met with in children between two and eight years old. Some authorities, as Coutts,[1] regard them as essentially different. Others, as L. Guthrie,[2] see no clear line of distinction between them as to nature and significance. In nightmare the child wakes suddenly without apparent cause from a sleep which has usually been somewhat disturbed, and screams out, owing to having had a bad dream. In night-terrors proper, according to Coutts, the sleep from which the patient awakes has usually been peaceful and his screams are due to his having "seen visions" rather than "dreamed dreams." Thus he cries out that a big dog or black man is threatening him; or he mistakes his mother, standing at his bedside, for a horse about to run over him. In both, the attack generally sets in shortly after the child falls asleep—at the very time

[1] *Amer. Journ. of Med. Sci.*, 1896, cxi., 156, and *Encyclop. Medica*, viii., 360.

[2] Allbutt and Rolleston's *Syst. of Med.*, 1910, viii., 804.

when, as A. Czerny has shown,[1] sleep is deepest; and it is not likely to recur the same night.

There are generally various elements in the *causation* of these conditions, and the share of each is difficult to apportion and to express. The general state of the child's nervous system is important as well as his age. Children of nervous families have these attacks oftener and more severely than others. Some of the worst instances of night-terrors I have seen began immediately after a severe fright. Local sources of discomfort, such as enlarged tonsils, adenoids, and chronic indigestion, are often partly to blame. A late and heavy meal is, of course, a recognised cause of nightmare.

The *treatment* of nightmare and night-terrors consists in attention to any predisposing and exciting causes which can be found. If adenoids or enlarged tonsils are present, the case is often permanently cured by their removal. In many cases, whether adenoids are present or not, attention to the diet will speedily remove the nervous symptoms. The restriction of starchy foods, vegetables, fruits, and sweets, combined with the administration of 6 or 8 grs. of bicarbonate of soda, two or three hours after each meal, often works wonders when the digestion is deranged. Regular night-terrors can often be rapidly stopped by a sufficient dose of antipyrine or some other sedative given at bed-time; and the strengthening of the nervous tone by the administration of a carefully given cold douche at bed-time has sometimes the best results.

It is, however, most important always to remember that the occurrence of such attacks urgently demands an investigation of, and probably a change in, the child's habits and surroundings as to diet, education, amusements, and hygiene.

Somnambulism.—Somnambulism does not usually occur in children under ten, and it is met with mostly between that age and adolescence. Its significance and the general lines to be adopted in its treatment are the same as in night-terrors.

Day-Terrors.—Attacks resembling night-terrors are occasionally met with during the daytime. Their causation, significance, and treatment are similar to those of the night seizures. They constitute an even more urgent sign of a vulnerable nervous system.

[1] *Jahrb. f. Kinderheilk.*, 1892, xxxiii., H. I., 1.

Other Morbid Fears in Little Children.—It is not uncommon for little children to have paroxysms of fear when they suddenly encounter a strange animal, a grotesque toy, or a member of one of the classes, such as policemen and "black men," that have a bad reputation in the nursery. Such incidents are not abnormal and can scarcely be said to lie within the domain of the doctor.

Occasionally, however, we are consulted about fits of terror which are distinctly morbid, not only in their severity, but also in the fact that they are set up by objects which the child has hitherto regarded with a friendly interest and no anxiety. Evidently some idea has got into his head which has altogether changed his relation to them. One has known attacks of this sort brought on by the sight, even at a distance, of such objects as a puppy, a motor car, an airship, or a pair of crutches; and every subsequent appearance of the object in question is followed by a paroxysm of screaming.

These attacks may conveniently, as far as treatment is concerned, be divided into two classes according to the degree of their severity—severe paroxysms in which the child is beside himself with terror and loses all his self-control, and slighter attacks in which, though intensely anxious, he can still control himself to some extent by an effort of will. These two degrees of terror are obviously of the same nature and due to the same causes.

Treatment.—The first thing to do in a case of this kind, is to set the parents' minds at rest by assuring them that the attacks, though they must not be allowed to go on, are not dangerous in themselves, if judiciously dealt with, and that their occurrence need cause no anxiety as to the child's mental condition or his future character. Fear does not necessarily signify cowardice and, though his terror shows that the child has a vivid imagination, it does not prove either delicacy or timidity. The patient indeed is often noticeably brave about other things that children are afraid of.

The measures to be taken with regard to the attacks vary according to the degree of the terror, and the extent to which his power of self-control is affected. In the case of the severe paroxysms, the main thing is to prevent him, for a considerable time, from seeing the objects which frighten him, and from hearing them spoken about. Once the paroxysm of fear has

seized him, he cannot help himself, and the only thing for the mother or nurse to do is to take him in her arms and give him all the sympathy and comfort possible till he can be got to forget his troubles in sleep.

The lesser attacks are also to be treated with the greatest sympathy; for, to the child, the causes of his fright are painfully real; and anything in the way of punishment, reproof, ridicule, or making light of his symptoms, is altogether out of place and can only do harm. As he has not lost all self-control, a good deal can often be done to help him to pull himself together when he feels the sensation of fright coming on. Two things may be mentioned that will assist him in doing so. The first of these is a cheerful and confident demeanour on the part of his seniors. This will go a long way towards enabling him to control himself. Fear, and the anxiety which predisposes to fear, are notoriously infectious; but calmness and confidence are equally catching. The other way in which the parents may help the child is by anticipating the onset of his fear, and suggesting to him at once to go and do something that will turn his thoughts in another direction. For example, should a visitor be announced whose appearance is likely to recall the dreaded subject, the chance of a screaming attack will be greatly lessened if the child is sent quickly to fetch her a chair or a flower, or to do some other easily performed service that takes him out of himself for the time.

In the earlier and more severe stages of the trouble, the child's fears should never be alluded to in his presence. Later, however, when he is beginning to recover and to regard the causes of his fear more normally, it will be well to introduce the subjects occasionally, to speak casually of their good points and harmlessness, and perhaps also of himself as being now too big and sensible a boy to be afraid of such things.

Insanity.

Ordinary insanity is rare in childhood and is scarcely ever recognised in infancy. When it occurs in early life there is usually a strong neurotic taint, and sometimes also a special exciting cause. Often the patient himself has already shown other signs of a weak nervous system; mentally defective children not uncommonly become insane.

In the rare cases in which *mania* occurs, it is sometimes associated with hysteria and sometimes with chorea. Occasionally it is due to some kind of septic poisoning, such as arises from a focus of diseased bone. When this is so, the mental symptoms are at once relieved by removal of the source of the sepsis. Most of the young children that I have seen with maniacal symptoms were epileptics, and many epileptic children show a high degree of mental exaltation and irresponsibility between their attacks.

Melancholia occasionally occurs in childhood after such exhausting complaints as influenza and enteric; and a considerable degree of mental depression is not uncommon in badly-nourished children in the course of various bodily diseases. Abnormally low spirits have a bad prognostic significance when they occur in a chronic ailment such as valvular heart disease.

A Temporary Loss of Moral Control which is akin to melancholia, is occasionally seen in children of school age. When such cases are met with, it is important that they should not be mistaken for instances of permanent mental defect, and that prompt and sensible measures of treatment should be taken. The patient who usually comes of a neurotic stock, and has probably been subjected to a great nervous strain—from bullying or some other form of unsympathetic treatment, or perhaps from an exhausting bodily disease—becomes quite changed in character and habits. He shows a lack of concentration in his school work, and, for the first time, is heedless, dirty, and untidy in his ways. He is untruthful, and shows no sign of shame when found out, though morbidly afraid of punishment. He feels dull and unhappy, wanders about aimlessly, and talks aloud to himself. Punishments only make him more miserable.

In such cases immediate and energetic *treatment* is called for. The bodily health must, of course, be seen to; but the main thing is a complete change of the child's surroundings. His ordinary lessons must be stopped, but it is advisable that a full routine of simple pleasant duties should be instituted, preferably out of doors, and that he should have no time for loafing. He must be treated with the greatest kindness and encouragement, and every effort made to restore his self-respect and confidence.

With proper treatment, the *prognosis* is quite favourable.

Such an attack, however, is a danger-signal, and is not to be forgotten in planning the boy's future work.

Various kinds of **temporary mental aberration** are occasionally met with in growing school children. For example, a girl approaching puberty who has hitherto shown every sign of being well brought up, becomes suddenly untruthful and gives long circumstantial accounts of adventures which have no foundation in fact, or develops a practice of indiscriminate pilfering. Such misbehaviour is not to be taken too seriously, and the child should not be spoken to much about it, for the condition is allied to hysteria. If the girl is treated with quietness and patience, and a judicious absence of fussing, she will probably soon return to normal ways; but, of course, she should be kept under observation.

Abnormal Naughtiness.—Occasionally a child, of perhaps three or four years, or older, is brought to the doctor because he is becoming so persistently and enterprisingly naughty that his parents have begun to doubt his sanity. He is generally found to be healthy and attractive-looking, and above the average in intelligence as well as in force of character, although we are given such a bad account of his conduct. We are told that the child is constantly doing wilful mischief—throwing china out of the window, knocking over flower glasses, scattering beads or other things that are troublesome to pick up, breaking in on other children's games so as to spoil their play, locking doors and throwing away the keys, pulling out drawers and emptying their contents on the floor, setting fire to anything that will burn, playing unkind tricks on the cat, and even upsetting the baby out of the cradle. The account of the child's misdoings is rather amusing; and one notices that, in spite of the anxiety which has occasioned the consultation, the parents describe them with just a touch of pride and a feeling that not every child would have the energy and cleverness to be so entertainingly naughty.

When we inquire into the treatment that has been tried, we usually find that, till recently, the child's mischief has merely been laughed at and rather encouraged. Since the parents have thought more seriously about the matter, however, the young culprit has been subjected to a course of severe corporal punishments, reprimands, and expostulations; and it has been attempted also to make him ashamed of himself by repeatedly

relating his misdeeds to friends and neighbours, in his presence, with severe comments. These measures have not caused the slightest improvement.

On considering the child's conduct, we see that the things he has been doing were calculated to give him little or no pleasure in themselves; yet they were a very real source of gratification because of the strong sensation they produced among his seniors. The effect of his misdeeds in disturbing his parents is the true secret of their attractiveness to him; and so great is the child's enjoyment of this that the beatings and other unpleasant experiences that followed have counted for nothing against it. They have been taken, indeed, merely as further evidence of the greatness of the impression he has succeeded in producing.

What is wrong with the child in such cases is a morbid exaggeration and perversion of the natural desire which all children feel for notice by their elders. He craves to be the most noticed person in the household; and the obvious, though unexpressed, admiration provoked by his boldness and resource is all the approval he needs to encourage him to continue.

This kind of exaggerated naughtiness is difficult, if not impossible, to distinguish with certainty during childhood from real permanent moral defect (p. 687); but the essential difference between the two conditions is that the merely naughty children are entirely reformed by judicious management.

The proper lines of treatment are clear enough; and, when carried out consistently and thoroughly, they are rapidly and completely successful. They may be summarised as follows:—

(1) All severe corporal punishment must be stopped. It never does any good.

(2) Nobody must ever appear shocked, amused, or even surprised, at anything the child does.

(3) His misdeeds are never to be alluded to, much less described, in his presence; and lastly, he should be noticed and encouraged in every way when he is good, and simply ignored when he is naughty.

Cases of this sort of abnormal naughtiness are met with not very rarely in children who are mentally somewhat defective. In them home treatment is extremely difficult; but the routine of a well-ordered institution is beneficial and soon inclines them to mend their ways.

On Certain "Bad Habits."

No consideration of the nervous and mental derangements of infancy would be complete which omitted the curious group of minor psychoses which, for want of a better name, are usually called "bad habits." This interesting group includes such tricks as pica or dirt-eating, sucking the thumb, tongue, etc., biting the nails, head-rolling, head-banging, rocking and swaying movements of the body, and masturbation.

All these habits consist in a morbid exaggeration of some insignificant normal action. The normal act causes only a little temporary satisfaction, while its morbid counterpart has an extraordinary fascination for the children who practise it. It may not, perhaps, be justifiable to say simply that these habits are infantile hysteria. They certainly, however, occupy among the diseases of infancy a very similar position to that held by various hysterical affections among those of later life. They are commonly met with, and are apt to be especially persistent, in children with other neurotic manifestations.

The essential character which serves clearly to distinguish these habits from other motor neuroses, such as spasmus nutans, chorea, and habit-spasm, which some of them superficially resemble, is their *deliberateness*. The child's will is implicated, and what he does is done intentionally, at first at least—because he likes doing it. They have a strong tendency to occur when he is feeling dull and not interested by his surroundings. They are almost always stopped when the child's attention is taken up with anything else that gives him pleasure.

Habits of this kind often occur during perfect health, but there can be no doubt that some, if not all, of them are specially liable to develop in children whose bodily and mental vigour have been lowered by chronic disease such as tuberculosis or severe indigestion. Their presence should always, therefore, suggest a careful investigation of the bodily health.

Pica or Dirt-Eating.

The children who suffer from pica have a craving to eat such things as earth, gravel, cinders, sand, wall plaster, or paper —sometimes they chew and swallow their own hair, and in rare cases they will even eat fæcal matter. The natural instinct

which tells us what is, and what is not, good for food seems absent in them altogether; and the discomfort which must result from the abnormal things which they swallow does not teach them, as it ought, to avoid such things in future. They suffer, as it were, from an hallucination of the appetite. Often there is no ascertainable general or local disease, and the children seem otherwise normal. Sometimes, however, we meet with "cachectic" cases. In these the craving begins with and evidently depends on a diseased condition of the alimentary tract, on the presence of worms, or on anæmia, and it passes off when these are cured. The practice is common among mentally defective children.

Symptoms.—Pica very often begins in infancy (six to eighteen months); as soon as the baby is placed within reach of the things he craves for, he tries to eat them. Thus, even before he can walk, he will be found licking the mud from his father's boots, or the dirt and gravel from the wheels of his own perambulator. When he begins to walk, he gets access to broken plaster on the walls, and later to all sorts of other things. In the distinctly cachectic cases, the symptoms may set in at any age for the first time. In many cases, only one kind of unnatural substance is taken; in others, a great variety.

If the habit is taken in hand soon after it has begun, it may usually be rapidly checked by the mother or nurse. If it has been allowed to go on for months, however, it may be hard to stop. In the early cases without noticeable cachexia, there is a strong tendency to spontaneous recovery during the third or fourth year, when the range of the child's interests in life is rapidly widening. Sometimes, however, the habit persists into late childhood or adolescence. Change of scene—for example, admission into a hospital ward—generally stops it at once for the time being. When it does persist, no serious harm follows in most cases. Fatal results have, however, occurred from eating sand, gravel, or hair; and severe diarrhœa is not uncommon.

Treatment.—The indications for treatment may be stated as follows:[1]—

1. *Keep the child away from the substances* for which he has a morbid craving. All habits are strengthened by practice, and their hold slackens under disuse.

[1] Thomson, "On Pica or Dirt-Eating," *Edin. Hosp. Rep.*, 1895, iii., 81.

2. *Treat the digestion.* Any local or general uneasiness tends to increase the craving.

3. *Improve the general health, and give iron if the child is anæmic.* These habits have a firm hold on the weakly; the strong more readily throw them off.

4. If possible, *change the child's surroundings* and occupy his mind with new interests. Let him be kept happy and busy.

Wetting the Hands.—Occasionally children are met with who have a constant craving to put their hands into water. This seems to be due to a delusive sensation of dryness, the skin being normally moist. It is a difficult habit to check. I have known it to last for many years in a highly neurotic girl.

Traces of **biting the nails** are very often seen (Fig. 47, p. 81), and callosities from constantly **biting the hands or fingers** are not uncommon, especially in nervous children. In treating nail-biting it is helpful to keep all the nails cut as short as possible; and, in the case of young children, the habit may be discouraged by the local application of a solution of quinine. The most effectual treatment is said to consist in having a small plate fitted by a dentist on the molars, in such a position that it prevents the exact apposition of the incisors.

Sucking of the Thumb or Fingers, the Tongue or other Parts of the Body, or of other Objects.[1]

The thumb and fingers are the parts most commonly sucked; less frequently the back of the hand, or part of the arm, or even, in young children, the big toe. The other objects made use of are such things as the mouthpiece of a feeding-bottle, a corner of the sheet or nightdress, or a kneaded-up piece of bread. Generally the same thing is sucked every time, but occasionally the child changes from one thing to another.

The habit is usually "simple," but often it becomes "complicated" in an interesting way. Thus a small boy who is punished for sucking his fingers gets into a way of covering his mouth with his other hand to hide what he is doing; he soon finds an added gratification from this "complication," and always uses it even when alone. Occasionally, also, cases are met with in which the children become violently excited while

[1] Lindner, *Jahrb. f. Kinderheilk.*, 1879, xiv., 68; Thomson, *Child-Study Monthly*, Chicago, June 1896, 98.

sucking, and may even injure themselves without seeming to notice it. For example, a patient of Lindner's, while sucking his thumb, used to work so roughly with the little finger of the same hand in one of his nostrils that he made it bleed.

The habit of sucking usually begins in early infancy, but it may start at any time. The degree to which it gains a hold over children largely depends on the passive, if not active, encouragement it receives from the nurse or mother. The nurse finds that to check the habit means provoking no end of restlessness, screaming, and ill-temper; while, on the other hand, to encourage it is an easy and sure way of making the child quiet and easily managed—"good" she calls it.

The times when children are most tempted to suck their fingers or other things, are shortly before falling asleep, soon after waking, and after their bath; also whenever they are in a low or depressed state of body or mind, or are cold, hungry, or out of sorts. The duration of the habit varies greatly in different cases. In some cases, the nurse or mother weans the child from it very soon. In others, it is allowed to continue till he goes to school, and then only slowly ceases owing partly to the notice of his schoolfellows.

Sucking usually does little harm unless it is much indulged in or is accompanied by excitement, but it should, practically always, be discouraged. I have, however, seen cases where a baby, with dangerously severe paroxysms of whooping-cough, was more soothed by being taught to suck a "comforter" than by any sedative medicine.

Treatment.—In cases where the sucking is accompanied by excitement, it is important, though sometimes very difficult, to stop the habit. When the finger or thumb is used, this may be best effected by the application of a light anterior splint or a stiff cardboard sleeve to the arm, so that the elbow cannot be bent. Anointing the part sucked with aloes or quinine may also be helpful. Generally if left alone the habit comes to an end of itself as the child grows older.

Sucking the tongue usually begins in early infancy and is difficult to stop until the child comes to years of discretion. It occurs in at least 90 per cent. of mongol children, and in a doubtful case of mongolism its presence is a point in favour of the diagnosis. It is also not uncommon in cretins and in mentally defective children of other types.

Rhythmical Movements.

Rhythmical movements of various parts are sometimes met with in children. These are of the nature of a bad habit, but are apt to be mistaken for neuroses of another kind.

One of the most striking habits of this class has been described by Gee[1] as *head-banging*. The patient, who is generally a child between two and six years, takes turns of facing his pillow and banging his forehead into it as hard as he can, at regular intervals of a few seconds. This goes on sometimes for several minutes, sometimes for as much as an hour at a time. It may alternate with swaying of the body or head-rolling. It takes place in some cases when the patient is wide awake, and in others when he seems nearly or quite sound asleep. The patients are sometimes deficient in intellect, and sometimes they are cachectic from tuberculosis or otherwise, but often they are quite normal.

Another common habit consists in rhythmical *jerking or rolling the head from side to side* as it lies with the occiput on the pillow. Much less commonly the child may have deliberate *nodding or shaking* movements of the head, while sitting up, which look like an exaggerated and intentional form of spasmus nutans.

Another variety which is often seen, consists in a *swaying or rocking* backward and forward of the body. The children sit, with a solemn expression, and slowly rock themselves forwards and backwards, sometimes for hours at a time, if left alone. This habit is common in mentally defective children and also in the blind, but it occurs too at times in normal children. It may be associated with one or other of the habits above described, or with masturbation; and it is often erroneously regarded as implying the presence of the latter.

Treatment.—A child who is beginning to practise such movements should be checked at once, and made to stand up and to run about or to lie down, whenever he begins them. In normal children who can walk, the habit is not difficult to check in this way.

[1] *St Bart. Hosp. Rep.*, 1886, xxii., 97.

Masturbation.

Every now and then we are consulted about masturbation in children. The patients may be of any age, but in the majority of cases they are infants. Girls are much more frequently brought to us on this account than boys. This is probably because in them the nature of the symptoms is more apt to be overlooked and the movements attributed to internal distress of some kind, or a fit, or to some other kind of nervous seizure, and therefore not checked.

Symptoms.—The act is practised in various ways—for example, by rubbing the thighs together, by working the body to and fro on the seat on which the child is sitting, or by pressing the vulvar region against the corner of a chair, or, less frequently, by help of the hands. The child seems intensely preoccupied at the time, gets flushed and excited, and often perspires. A sort of panting or grunting expiration often accompanies the act; and mothers not infrequently refer to this as showing that the child is in pain. If the movements are stopped, however, there are always active signs of annoyance. If the act is not interfered with, more or less exhaustion follows it.

Treatment.—The treatment of confirmed cases of masturbation in *older children*, who feel that they are doing wrong, is often excessively difficult, and in planning it we have to be largely guided by the circumstances and surroundings of the case. In *young children*, however, the matter of cure is comparatively simple and easy. The habit in their case is in no respect a moral offence, and it must not be treated as such. At any age the parents' attitude towards it should be firm but altogether unemotional. They should, in fact, treat it simply as they would any gross breach of ordinary good manners. The main indications for treatment are as follows:—

1. *Remove any local irritation present.* Phimosis, preputial adhesions, balanitis, vulvitis, hyperacidity of the urine, and thread-worms may probably all be predisposing factors.

2. *Attend to the general health and hygiene.* See that the diet is judicious and not too nitrogenous, and the bed-clothes not too heavy. Order a cold douche in the morning and plenty of open-air exercise.

3. The child *should not be punished* or even scolded; and,

once she knows that indulgence in the habit is a direct act of disobedience, that should be the only aspect of the question kept before her. The habit should never be alluded to in her presence, and especially never treated as horrible and interesting.

4. The slightest attempt at the act *must be invariably stopped* at once. If this can be done, the child very soon learns that to begin it inevitably means subjecting herself to annoying interference. This spoils the pleasure of the habit altogether so that it loses its fascination.

5. If these means fail, *mechanical devices* must be tried to render the act impossible. In cases in which it is always practised with the hands, this can easily be done by using splints which fix the arms at less than a right angle. If pressing the thighs together is necessary to its performance, it can be stopped by some device which prevents their coming together comfortably. If the main thing is a to-and-fro movement of the pelvis, nothing short of a double long splint, some sort of Phelps' box, or double Thomas' hip splint, will be sufficient.

6. Much ingenuity should be expended in *keeping the child happy*, busy, and interested in proper subjects.

After considerable experience of these cases, I am sure that when such measures as the above are thoroughly carried out, complete and permanent success may be expected even in the worst of them.

Epilepsy.

Symptoms and Diagnosis.—Ordinary idiopathic epilepsy, in the form of grand or petit mal, often begins in early childhood. It is certain, however, that a considerable proportion of the cases in children which look at first like regular epilepsy turn out to be merely symptomatic convulsions. They may, for example, prove to be due to past or present organic disease of the brain. Oftener they are of the nature of functional disturbances, set up or predisposed to by pyrexia, intestinal toxæmia, or emotional excitement in children with an impressionable nervous system. This often happens in older children as well as in infants.

The question whether, in a given case, the convulsions are idiopathic or merely symptomatic of a passing disturbance, is

of importance with regard to the prognosis; but the relation between the two groups of cases is a very difficult matter. It is often indeed impossible to speak positively as to the nature of the case at the time of the first convulsion, and our opinion should always be guarded. The following particulars, however, may have considerable significance. If fever, acute dyspepsia, or symptoms of lithæmia are present; and, in the case of a second convulsion, if they were present also on the former occasion, this is strongly in favour of the case being symptomatic. The presence of a family history of epilepsy is in favour of the case being idiopathic. A large proportion of the children who suffer from true epilepsy have also more or less noticeable mental peculiarities. Sometimes, there is merely a degree of dullness or depression, probably accounted for by the bromide taken; but, in a large proportion of the cases, the disease produces a tendency to mental exaltation, an abnormal absence of shyness, a want of mental balance, or an uncertainty of temper. The presence of peculiarities of this kind very greatly increases the probability that the case is one of true epilepsy. In a large proportion of the cases of true epilepsy in childhood, the child neither wets himself nor bites his tongue during the attack.

Prognosis.—The prospect of recovery in cases of epilepsy is always a question of great anxiety. Occasionally, we meet with children whose fits cease under treatment, and who recover completely for a time or even permanently. In these cases there is usually no mental impairment or peculiarity noticed. When the fits continue to recur for any length of time, however, there is practically always some deterioration of the intellect. A perfectly sane epileptic child is seldom seen—at least among those in whom the disease began in early childhood. In the large majority of cases in which the fits continue, the mental and emotional peculiarities increase steadily until a severe degree of mental defect results (p. 686).

Treatment.—In considering the treatment of a case of epilepsy, attention should first be directed to any of the above-mentioned local conditions which may possibly be causing irritation. Sedatives—especially bromides—are sometimes of considerable, although limited, value. Their effect on the general health must always be watched, and they must be stopped if it is not satisfactory. Bromide of soda or potash

may be given in doses of 2 to 4 grs. thrice daily for a limited time to a child of twelve months, and 5 to 7 grs. to one of three to five years. The salt should be freely diluted. If the fits tend to recur at a certain time of day, a double dose may be given shortly before they are expected. If the bromide is to be given for a long time, a drop of liquor arsenicalis may be added to each dose to lessen the tendency to a bromide eruption. When the fits stop with the use of bromide, the drug should be continued for at least a year. Should the circulation be feeble, as sometimes happens in cases in which the fits only occur during the night, considerable benefit seems sometimes to follow the administration of digitalis. Borax (2 to 5 grs.) is useful in some cases in which bromide alone fails. When the attack is preceded by an aura, it may possibly be averted by the inhalation of amyl nitrate; and occasionally the sniffing up into the nose of powdered chloride of sodium has a similar effect.

The parents may suggest a surgical operation, but this is never of any benefit.

In regulating the diet of epileptic children, strict moderation at all times must be inculcated. The ideal is not great restriction, but small simple meals eaten with an appetite. It is advisable not to allow much butcher-meat, and some children probably do best without any. But it is just as important not to allow an excess of starchy and sweet foods to children whose intestinal digestion is weak. The action of the bowels must be regular and free; and plenty of open-air and regular exercise, without excitement, are very beneficial.

The question of schooling and of how otherwise the child is to spend his time, is a very important one. On this matter we must give positive directions, and not merely forbid lessons and say that the child is to run wild. As Dr Ashby excellently puts it,[1] "If 'running wild' means involuntary idleness, an aimless and empty existence without discipline and control, and a more than ever concentration on self, then 'running wild' is the worst possible treatment for fits. By all means arrange for many hours in the open air, but find objects of interest, outdoor work, and outdoor play. Then consecrate some part of the day, be it only a couple of hours, to some indoor employment. There is no real fear of overworking juvenile brains if

[1] *Lancet*, 21st Jan. 1905, 138.

the subject-matter is not concerned with desks and books but is made interesting, and the employment and lessons are short and varied, and intervals of outdoor relaxation are frequent. The child is a social animal, and the society of other children, if well under control, has a powerful influence for good; and the more neurotic the child, the more need is there for his contact with others. To allow the neurotic child to feel that he is the first to be considered, to let him think that every little ache, every little disappointment, and every discomfort are sore trials, is to be doing all that can be done to blight his future. Give him daily employment, everything well within his powers, and look for accurate performance. Defer if you will all abstract learning to a later day, but find for him an active and occupied life; lend him a firm hand that may help to forge and strengthen the links of voluntary power and self-control which will prove important factors in preventive medicine and save many a sorrow."

Neurasthenia.

Neurasthenia may be defined as "hyper-sensitiveness of higher centres with proneness to general exhaustion of nervous energy, mental and physical; whilst hysteria is characterised by excitability and explosiveness of higher centres, associated with local sensory and motor paralysis, and deficient powers of control of emotional display."[1] The two conditions are often met with together.

The most typically neurasthenic child I have seen was a bright, pleasant-looking little girl of nine, who came of a very neurotic family. Her general health had been good; but all her life she had been subject to symptoms of mental and bodily exhaustion after excitement. So long as she lived quietly with adult relatives, who were sensible people, she was like any other happy contented child—obliging, good-natured, and thoughtful for others, fond of animals and very patient with them. She was keenly interested in most of her lessons and was very well read for her age. She had never been regularly at school for a long period, for, after repeated attempts, it had been found that she was quite unable to bear the strain of ordinary school attendance. When sent to school she would be full of interest

[1] Leonard Guthrie, *Functional Nervous Disorders in Childhood*, London, 1907, 15.

in her lessons for the first few days, and her teachers, being much impressed by her intelligence and originality, would predict great progress. In a short time, however, she would become tired and irritable, and in spite of being given less work and allowed to take a day in bed occasionally, she would get so spiritless and muddled that her schooling had to be stopped altogether.

Once, when seven years old, she was severely frightened by a tramp who tried to assault her. Just before, she had been making remarkable progress in arithmetic. After the fright, she seemed collapsed, and on returning to school was found to have lost for the time all power of doing even the simplest sums.

In cases of this kind the main treatment consists in attention to the bodily health, in avoiding all forms of excitement at home, and, especially in strictly limiting the extent to which the patient associates with other children in school or elsewhere, so long as doing so is found to be exciting and injurious.

Hysteria.

Manifestations of hysteria are rare in children under six years, but occasionally they are met with even in infants under two. As has been already pointed out (p. 573), the place occupied by hysteria in later life seems to be taken to some extent in infancy by various of the so-called "bad habits."

In children between nine years and puberty who belong to neurotic families, hysterical affections are not uncommon; and boys are often affected, though not so frequently as girls. In these older children also, hysterical symptoms are apt to be associated with chorea, habit-spasm, epilepsy, and various forms of mental disease.

Symptoms.—Hysteria may manifest itself in childhood, as in later life, either by motor, sensory, or psychical symptoms. These are usually less complicated than in adults. Among the sensory disturbances, hyperæsthesia or pain on movement of some part is common. Headaches are also often complained of. Anæsthesia is only rarely found. Hysterical joint affections have been already dealt with (p. 77). Motor symptoms, such as contractures of the limbs or, less commonly, paralysis, are frequently seen, and the muscles of the larynx are among

those most commonly implicated. Painless and effortless vomiting after meals is not very rare in older girls, and it must be remembered that something like it sometimes occurs in babies (p. 125).

An interesting motor symptom which is occasionally met with in hysterical babies, and which I have known mistaken for spastic diplegia, is the so-called "flexibilitas cerea." In this condition the child's limbs are held stiff; but they can readily be put into any position and will remain so for a long while, the child looking absorbed and gratified all the

FIG. 160.—Flexibilitas Cerea. Girl of 17 months.

time (Fig. 160). The symptom usually begins after some weakening ailment such as an attack of diarrhœa. If much sympathetic attention is given, it will continue indefinitely and become more marked. Even under treatment it may last for weeks or months. The treatment, apart from attention to the general health, consists in distracting the child's mind from his symptoms and getting him interested in outside things; and especially in inducing him to use his limbs in any way.

The mental condition in hysterical children is generally characteristic. They show the usual intense interest in their symptoms and a distinct gratification in having them examined

and talked about. In older girls we sometimes meet with mental depression and peculiarity, accompanied by anorexia and obstinate constipation.

The **diagnosis** of hysteria is made mainly, as in adults, by excluding the presence of organic disease sufficient to cause the symptoms. We must, of course, always bear in mind the *possibility* of organic disease and hysteria being co-existent. The patient's demeanour is often quite characteristic; and, if a girl tells you with a placid smile that her pains have been "agonising," you may confidently diagnose that they were hysterical in nature.

The **treatment** is generally most satisfactory, provided the child can be removed at once to a hospital or nursing home, or to the house of a judicious friend. Such a change of surroundings, with the elimination of morbid sympathy, is often all that is necessary for a rapid cure. Sometimes, however, a good deal of patience as well as tact may be required.

When the child is emaciated, and has loss of appetite and constipation, a course of general massage and feeding-up (Weir-Mitchell) are of great value. If the limbs are affected, local massage, faradism, and douching are indicated. Laxative and tonic medicines have a useful function, and sometimes valerian seems to do good. During such bodily treatment it is of the greatest importance that every effort should be made to make the child happy and hopeful, and to transfer her interest from herself to other things. Bad habits should be watched for and checked if present. In cases of hysterical vomiting which do not recover at once on general treatment, we may order drop doses of liquor arsenicalis, or two drops of laudanum immediately before food. Babies with neurotic vomiting are also sometimes benefited by small doses of liquor arsenicalis ($\frac{1}{4}$ to $\frac{1}{2}$ a drop).

When the patient has begun to improve satisfactorily, she will benefit from a thorough change of scene, and nothing is better for her than the varied open-air interests of farm life. When her health seems re-established, a happy, well-regulated school routine will be useful in promoting healthiness of mind and preventing recurrence of the hysterical symptoms.

Habit-Spasm (*Habit-Chorea*).

Habit-spasm is a fairly common affection, both in boys and girls, between six years old and puberty. It often appears in those whose bodily strength has been lowered by illness or bad feeding, or who are suffering from nervous strain from mental overwork, worry, or shock of some kind, and sometimes in children who have been spoiled.

Symptoms.—The twitching movements which are characteristic of the disease are most frequently seen on the face or head. There may be blinking of the eyes, screwing up of the nose, a sudden nod or shake of the head, or a shrug of the shoulders. Sometimes there are grasping and other movements of the hands, or jerking of the lower limbs and trunk. Often, in the severer cases, there is a tendency to repeated noisy clearing of the throat, or to the sudden ejaculation of some word; and as often as not the word is a specially undesirable one (coprolalia).

Diagnosis.—In typical cases of habit-spasm, the movements differ considerably from those of ordinary chorea, being quicker and less extensive, and also being repeated over and over again in the same way, instead of being varied irregularly. Another point of difference is the effect which the presence of onlookers has on the movements. In habit-spasm they are diminished or stopped when the child knows he is being watched, while the movements of ordinary chorea are generally exaggerated under these circumstances. Atypical cases of habit-spasm may, however, at first sight look very like chorea. Besides the characteristic movements, the children often show excitability, irritability, passionateness, and obstinacy; and sometimes are very difficult to control. Many sleep badly or have headaches. Unlike chorea, habit-spasm is apt to spread by imitation; and also, unlike chorea, it may last for years, if not successfully treated. Although habit-spasm is not a manifestation of rheumatism in the sense that chorea is, it is certainly not uncommon to see it in rheumatic children.

The **treatment** of this apparently trivial complaint is often extremely difficult and disappointing; and, as Still says, "there are few disorders of childhood out of which the medical attendant is likely to gain less credit."[1] The fact of the disease occurring at all, shows that the child's nervous system is in an

[1] "Habit-Spasm in Children," *Lancet*, 16th Dec. 1905, ii., 1754.

unsatisfactory state; and in all well-marked cases, before we can hope for recovery, a complete and prolonged change in his surroundings and in his ways of life is called for. A rapid cure can never be expected. The main indications for treatment may be stated as follows:—

1. To begin with, the child's mental condition must be seen to. All sources of distress, such as fear of punishments or bullying, must be stopped. The child must receive every encouragement, and his mind be kept fully occupied in a pleasant way.

2. If the movements are severe, the patient may be urged to use his self-control to check them, but anything like punishment or even scolding is injudicious. Constant fault-finding is also bad, because it keeps the child's attention fixed on the habit.

3. School attendance must usually be stopped; but it is often good for the child to have an hour or two of lessons in the day. The subjects chosen should, at first at least, be those to which he has least objection, and those over which he does not become excited.

4. The child should be encouraged to sleep as long as possible, and all causes of excitement must be avoided.

5. He must, if possible, be made fat; and, if there is distinct malnutrition, it is generally a good plan to begin with a course of Weir-Mitchell treatment. Generally, however, moderate exercise, feeding-up with extra milk, congenial companionship, and a healthy out-of-door life, are what is wanted.

6. Any local sources of irritation, such as adenoids or refractive errors, should certainly be attended to.

7. In most cases, drugs are not of much importance. If the child is anæmic, however, he will probably benefit greatly from a course of iron. A combination of arsenic and bromide of potash is recommended by some. Still has seen benefit from ergot and nux vomica (ext. ergot. liq., ½ to one dram; tinct. nuc. vom., five minims t.i.d.). Valerian seems also, at times, to have a good effect. Electricity has been much used, and is thought by some to do good.

Chorea.

Chorea is essentially a disease of childhood, and is met with most commonly between the ages of five and fifteen years, and

more frequently in girls than in boys. It is a subacute disease, lasting generally from six to ten weeks or more, and showing a strong tendency to recur. In exceptional cases it may last as long as a year or even more, especially in children who are mentally dull. Certainly, however, the great majority of so-called "chronic choreas" are really instances of habit-spasm, if not of Friedreich's ataxia or some other organic disease of the central nervous system. In a large proportion of cases, chorea is beyond all doubt a manifestation of rheumatism. Its occurrence, therefore, should always suggest a thorough investigation as to the presence or history of subcutaneous nodules, joint pains, heart lesions, and other rheumatic manifestations.

Symptoms.—The two main characteristics of an attack of chorea may be described as (*a*) a faulty control of the voluntary muscles; and (*b*) a faulty control of the emotions.

(a) *The faulty control of the muscles* shows itself in three ways. (1) There is *inability to keep still.* If the child is told to keep her hands lying flat on the bed clothes in front of her, she is unable to do so for any length of time, and the asking of a simple question will almost invariably set them twitching. (2) There is usually more or less marked *inco-ordination*, and the patient may have great difficulty, for example, in picking up a pin. She tends to drop things she is carrying, however anxious she is not to do so. (3) There is always present a degree of *paresis*, and in some instances this symptom is so distinct as to cause the case to be mistaken for one of paralysis of some kind; it should, however, be easily recognised. It always sets in gradually, and is never absolute. The muscles are flaccid, and there is no wasting. Some characteristic irregularity of movement will always be recognisable if watched for.

As Dr Lees pointed out,[1] it is the muscles over which we have most voluntary control, and those by which we are accustomed to express emotion, that are most affected in chorea, namely, those of the face, tongue, hands, and arms. In slight cases the movements are sometimes apparently confined to one side.

(b) *The faulty emotional control* is also manifested in various ways; and probably the disorderly muscular movements are no more characteristic of the disease than are the mental and

[1] "The Pathology and Treatment of Chorea," *Brit. Med. Journ.*, 29th Aug. 1903, ii., 449.

emotional changes. The child is changed in disposition and temper and is subject to emotional outbursts. There is often a state of temporary mental dullness, with loss of memory and low spirits; and more or less complete aphasia is common. The way in which the expression of the face is altered in chorea is very striking in some cases, as Dr J. S. Fowler has pointed out to me (Figs. 161 and 162). In estimating the extent to which chorea has affected the mental functions, it must be borne in mind that the disease often affects children whose mental power is rather below the average. In such cases the duration of the symptoms is apt to be much longer than it is in the case of bright, intelligent children.

Treatment.—In beginning the treatment of chorea, we must not forget the large part which emotional disturbance plays in its causation, and we must aim at *setting the mind at rest*. With this in view, the child must be protected from all causes of annoyance from without, such as the presence of other children or strangers is apt to bring. She must also be encouraged and made to feel that her disorderly movements are not in any way her fault, and that she will soon be well. Her mind should, if possible, be taken off herself in a pleasant way by simple amusements, so that she may not weary and become depressed. At the same time it is important that she should not be given in to or spoiled; and many cases will do better if nursed by a kindly stranger in new surroundings, than amid the more relaxing influences of home.

The patient should always *be put to bed* at first and kept there for a varying number of weeks, according to the severity of the attack. She should, preferably, be nursed in a room apart from the other children. When the muscular movements are violent, it may be necessary to have the iron framework of the bed padded; and, in the worst cases, a water-bed is desirable.

A *fair amount of nourishment* must be given in an easily digestible form. For this purpose nothing is as good as milk, of which large quantities should be ordered. Many children, however, fret and do not gain weight if kept on milk alone; and, for them, the addition of farinaceous food is distinctly beneficial. If the child gains weight steadily, it is a good sign. It is most important that the bowels should be kept regular. General *massage* is a very useful aid to the nutrition.

FIG. 162.—Same patient after convalescence.

FIG. 161.—Physiognomy of Chorea at onset of attack.

Warm baths are soothing, and in cases where the movements are unusually violent, the application of hot packs has often an excellent effect.

The *medicinal treatment* of chorea is a matter on which a good deal of difference of opinion exists. Of the great value of drugs in suitable cases, there can be no doubt. There are, however, many in which the use of any medicine is quite unnecessary, as the child recovers rapidly and satisfactorily if kept quiet in bed, fed up, and massaged. In others, however, no decided improvement occurs until drugs are given. It may be regarded as always advisable, unless anti-rheumatic treatment seems urgently called for, to defer the administration of medicinal remedies until the effect of isolation, rest, suitable feeding, and massage have been tried for a week at least.

The medicines of which I have had most experience are antipyrine, salicylate of soda (with bicarbonate), arsenic, and ergot. In most cases I prefer to use antipyrine, as it is the safest and pleasantest of these remedies, and usually as efficacious as any of the others. Should there be active symptoms of rheumatism, salicylate may be preferred. Arsenic and ergot may be usefully employed in obstinate cases where other drugs have failed.

The details of the administration of these drugs are as follows:—

Antipyrine.—To be effectual, antipyrine must not only be given in considerable quantities, but in large doses at a time.[1] The dose should amount to $1\frac{1}{2}$ gr. for each year of the child's age (*e.g.* 15 grs. for a child of ten years). It should be given twice on the first day, thrice on the second, four times on the third, and five times on the fourth day; and then continued five times a day for about a fortnight.

Before giving antipyrine in this way the urine must always be examined to see that its quantity and sp. gr. are normal and that it is free from albumin; and its characters should be watched while the drug is being administered. Occasionally an antipyrine rash (p. 334) may occur with or without albuminuria and vomiting. These symptoms rapidly subside on the medicine being stopped. I have never seen any symptoms of collapse following antipyrine in these doses. Its effect on the choreic

[1] Jules Comby, *Arch. de Med. des Enfants*, April 1899, 193.

movements is generally most marked, and the children often gain weight while taking it.

Salicylate of Soda with Bicarbonate.—Large doses of salicylate of soda have been strongly advocated by Dr D. B. Lees.[1] He recommends that the dose for a child of six to ten years should be at first 10 grs. with 20 grs. of sodium bicarbonate. After two or three days the quantities should be increased to 15 grs. and 30 grs. respectively. After two or three days more, they may, if necessary, be increased to 20 grs. and 40 grs. These doses should be given every two hours during the day, and every four hours during the night—ten doses in the twenty-four hours. Thus the total amount of salicylate given at first is 100 grs. daily, increased to 150 grs. and later to 200 grs. In some cases Dr Lees gave as much as 300 or even 400 grs. in the day to older children, with double the amount of soda.

A careful watch must, of course, be kept for any symptoms of salicylate poisoning, and especially for a peculiar deep inspiration accompanied by acetone in the breath and in the urine.[2] If this symptom occurs, the medicine must be stopped immediately, and large doses of bicarbonate of soda given, as in other forms of acetonæmia (p. 457). To prevent its occurrence it is *very important* that the bowels should be kept freely open all the time that the salicylate is being taken.

After considerable experience of this method of treatment (with the smaller doses up to 100 grs. in the day), I am inclined to prefer it in cases where there is either a rheumatic history or any rheumatic manifestation present, besides the chorea. Occasionally vomiting occurs, and the drug seems to depress the pulse. The depressing effects of sodium salicylate have certainly, however, been greatly exaggerated. In the vast majority of cases they are quite inappreciable. When vomiting occurs, the drug should be stopped for a day or so and then recommenced. It is a striking and significant fact that during this treatment also, children often gain weight steadily.

Arsenic.—Arsenic must always be given with caution, and according to precise rules. Otherwise neuritis may

[1] *Brit. Med. Journ.*, 29th Aug. 1903, ii., 450.

[2] Fred. Langmead, "Salicylate Poisoning in Children," *Lancet*, 30th June 1906, i., 1822.

result, and arsenical neuritis is sometimes not wholly recovered from. It is safer, as well as more efficacious, to give the drug in large doses for a short time than to use smaller quantities for a longer period. Dr William Murray[1] recommends 15 minims of liquor arsenicalis, well diluted, with food, thrice daily for a child of six or eight. This must never be continued for more than a week. This caution is generally, however, unnecessary, as the arsenic has often to be stopped by the fourth or fifth day on account of vomiting and other indications of poisoning. The effect of these large doses is often very striking, and even severe cases may be almost cured in a week. In bad cases of chorea small doses of arsenic have no effect.

The symptoms of arsenical poisoning, other than vomiting, which are to be watched for, are a general flushing of the skin, redness and itching of the eyelids, a white fur on the tongue, diarrhœa, and sometimes a rise of temperature with albuminuria. They are most apt to occur when the dose given is small at first and is steadily increased during some weeks. When the medicine is discontinued the symptoms rapidly pass off. After considerable experience of this method of treatment I have not met with any case in which it has caused neuritis; but before beginning to give arsenic we must always make sure that the patient has not been having the drug already, or there may be grave danger of too much being given.

Ergot. — Eustace Smith strongly recommended the use of ergot in chorea.[2] He gave the liquid extract, in doses of 60 to 120 minims, every two or three hours, to children of all ages, and continued it for weeks. These large doses are generally borne quite well, and they should be continued for weeks, until the abnormal muscular movements have ceased. Sometimes, however, the drug has to be stopped on account of sickness and weakening of the pulse. There is no risk whatever of ergotism with such doses. The effect on the choreic movements is often rapid and striking, but the amount of nausea sometimes produced has seemed to me to make it rather an unpleasant form of treatment. A less nauseous form of the drug is ergotine, which may be given in 5-gr. doses every

[1] *Rough Notes on Remedies*, 3rd ed., 1899, 16.
[2] *Brit. Med. Journ.*, 18th July 1903, ii., 133.

three hours to children of all ages, and increased by 2 grs. every week till 14 grs. are taken.

Convalescence.—When the patient is convalescent, change of air and scene are most beneficial. Gymnastic exercises and musical drill are also useful in helping her to recover complete control over her unruly muscles. Iron and other tonics are sometimes indicated. Should the choreic movements begin to return, the administration of small doses of arsenic is often efficacious in checking them.

Spasmus Nutans (*Head-Shaking with Nystagmus*).

Spasmus nutans is a functional co-ordination-neurosis affecting infants under two years, and is seen mostly in poor children who live in dark rooms. It generally begins between the fourth and twelfth months—at an age when the baby is spending much of his time and energy in perfecting himself in the difficult art of raising his head, turning it round, converging his eyes, and focussing his accommodation.

Symptoms.—The two principal symptoms—involuntary nodding or shaking of the head, and ocular nystagmus—are usually both present, but either may begin some weeks before the other. Sometimes, however, head movements alone are observed; while in other cases only the peculiar nystagmus is seen. The movements of the head may consist in simple forward nodding, but lateral or rotatory shaking is commoner. They cease when the child is lying down, and also when the eyes are closed, voluntarily or otherwise. The nystagmus is rapid and of short range. Its unique character has already been described (p. 550); and it is so distinctive that it is easily recognised, even when unaccompanied by head movements. The nystagmus is generally increased in extent when the head is held steady, and sometimes it only appears when this is done, or when the child looks to one or other side.

Rhythmical contraction and dilatation of the pupils (hippus) may sometimes be found; and, occasionally, convergent strabismus develops. The child has often a peculiar trick of turning his head to one side and staring fixedly out of the opposite corners of his eyes—usually in an upward direction. This gives him a curious preoccupied look. In other cases he throws back his head and looks with his eyes

directed downwards as if he had bilateral ptosis (Fig. 163). The exact explanation of this symptom is obscure, but there seems no reason whatever to regard it, as some have done, as a sort of petit mal attack. The intellect is never at all affected as a result of spasmus nutans. It should, however, be mentioned that children whose intelligence is below the average seem rather prone to be affected with the disease. The movements of the head are, to a large extent, beyond the child's control. They are noticeably increased when his attention is aroused. For this reason they are generally at their height when the child has come through crowded streets to the waiting-room. They diminish with drowsiness, and cease during sleep.

FIG. 163.—Attitude in Spasmus Nutans. Girl of 20 months, showing peculiar way of holding the head back.

The symptoms usually begin suddenly, and almost always in mid-winter. They seldom last less than six weeks, usually for three to six months, and sometimes for longer. The condition always ends in complete recovery, with the exception that, should strabismus occur, it may be permanent. Occasionally there is a recurrence of the symptoms in the following winter, but this is rare.

Causation.—The causation of this disease, like that of chorea, is somewhat complicated.[1] Among the chief factors

[1] W. B. Hadden, *Lancet*, 14th, 21st, and 28th June 1890, 1293, 1349, and 1416, and *St Thomas's Hosp. Rep.*, 1890, N.S. xx., 205; R. W. Raudnitz, *Jahrb. f. Kinderheilk.*, 1897, xlv., 144; H. Rietschel, *Charité-Annalen*, 1906, xxx., 152; Thomson, *Scot. Med. and Surg. Journ.*, July 1900, vii., 7; and *Brit. Med. Journ.*, 30th March 1901, i., 763.

we may reckon the child's age, the absence of sufficient sunlight in his surroundings, and the presence of rickets. Falls on the head and the irritation of teething seem sometimes to act as determining causes, and anything that lowers the general vitality may probably be regarded as predisposing. I have never found any connection between this ailment and ear-disease.

Diagnosis.—Spasmus nutans is generally easy to recognise. Eclampsia nutans, or the "salaam convulsion," has sometimes been confounded with it. That is, however, quite a different disease, being a form of epileptic seizure met with in mentally defective children and associated with grave cerebral lesions.

The deliberate rhythmical jerking or shaking of the head in neurotic children, referred to in a former chapter (p. 577), is also easily distinguished from spasmus nutans. In it the movements have a wider range, nystagmus is absent, and the head-shaking ceases when the child's attention is arrested and increases when he is left to himself. It is also generally seen in older children.

Treatment.—Spasmus nutans usually improves steadily and satisfactorily under anti-rachitic and tonic treatment. The chief thing is to secure abundance of fresh air and sunshine, and to give cod-liver oil and phosphorus. While sedatives such as antipyrine certainly seem, in some cases, to diminish the movements, they cannot be held to be of much importance.

CHAPTER XXIX

ON SOME FORMS OF PARALYSIS

THE various forms of paralysis met with in children may be conveniently divided into two groups, according as the symptoms have dated from birth or have set in during infancy or later childhood.

Paralyses Dating from Birth.

Paralysis which is present from birth may be due to intra-uterine disease or to arrest of development; but it is often the result of an injury during delivery.

Peripheral Birth Palsies.

In peripheral "birth palsies," the nerves of either the face or the arm, or sometimes of both, may be involved; the lower limbs are very seldom damaged, because their nerves lie so deeply that they are protected from external injury.

Facial Paralysis often occurs in new-born children as the result of pressure on the facial nerve during delivery. It is generally due to the pressure of the forceps; but, in a few cases, the promontory of the sacrum may be to blame. The weakness is usually recovered from in a few days or, at most, within a fortnight. Occasionally, however, it lasts for months or may possibly become permanent.

The diagnosis seldom presents any difficulty, as the only condition which may be mistaken for it is *congenital defect of the nucleus of the seventh nerve.*[1] This lesion should always be remembered when facial palsy is present at birth after an easy labour. Should both sides of the face be affected, or

[1] H. M. Thomas, *Journ. of Nervous and Mental Disease*, Aug. 1898, xxv., 571; Heubner, *Charité-Annalen*, xxv., 1900, 211; Rainy and Fowler, *Review of Neurol., and Psychiat.*, March 1903, i., 149.

should one or more of the ocular muscles be also paralysed, these are points in favour of this diagnosis.

The treatment of facial paralysis from birth-injury is largely expectant; but, if recovery is delayed, gentle massage may be used.

Paralysis of the Arm arising during delivery is due to injury of the cords of the brachial plexus. It may occur in head-presentations, but is commoner in breech-cases. The injury may be done by direct pressure of the end of the forceps, or by the accoucheur's finger, provided the force is applied while the plexus is on the stretch, owing to the head and the shoulders being pulled in different directions. Sometimes, apparently, it results from severe traction on the arm only, or from lateral twisting of the head during the extraction of the child.[1] Occasionally both arms are affected (Fig. 164).

In the great majority of cases, it is the upper cords of the plexus (5th and 6th C.) that are implicated, and the paralysis is of the "upper arm type" (*Erb's paralysis*). In these the position of the arm is very characteristic. The shoulder is fixed and the elbow fully extended, while the humerus is rotated inwards and the forearm pronated, so that the palm turns backwards or even outwards. After a few weeks, there is flattening of the shoulder and atrophy of the upper arm. The forearm is not wasted, and the hand movements are little interfered with. The muscles involved in a typical case are the deltoid, biceps, coraco-brachialis, and brachialis anticus, the supra- and infra-spinatus, the teres minor, the supinator longus, and sometimes the supinator brevis. No sensory changes are discoverable.

The "lower arm type" (*Klumpke's paralysis*) is much less common. In it the lower cords (8th C. and 1st D.) are affected. The paralysis affects the small muscles of the hands and the flexors of the fingers in the forearm. There is some anæsthesia in the ulnar region. There may also be myosis on the side of the lesion, with sluggish contraction of the pupil and diminution of the palpebral fissure.

Cases of both types are apt to vary considerably in the exact distribution of the paralysis, owing to irregular involve-

[1] E. F. Trevelyan, "Peripheral Birth Palsy," *Quart. Journ. Med.*, 1908, ii., 1908-9, 405.

ment of the cords. Sometimes there is separation of the upper epiphysis of the humerus, or fracture of the clavicle or humerus, in addition to the nerve injury. Dislocation of the

FIG. 164.—Erb's Paralysis of both arms. Girl of 3 months. Breech presentation. (Dr Peter Davidson's case.)

shoulder-joint may also occur; and in many cases a secondary subluxation of the head of the humerus takes place and constitutes a troublesome complication in the treatment.[1]

The diagnosis is generally easy, provided it is known that the paralysis has existed from birth, and that the birth was

[1] Whitman, *Orthopædic Surgery*, 6th Edition, London, 1919, 469.

a difficult one. Should no clinical history be forthcoming, however, the case may be mistaken for one of poliomyelitis.

Treatment.—The paralysed limb should at first be wrapped loosely in cotton-wool, and kept quiet and warm against the chest in a sling; and a light splint should be applied to keep the forearm supinated and the fingers extended. As the limb gets less sensitive, each of the joints should be moved several times a day to a natural extent, and gentle massage applied to the muscles. Electricity is of no advantage. As the treatment proceeds, it is important to see to it that the head of the humerus is kept in its proper position and not allowed to become fixed in a state of subluxation. For this purpose, it is sometimes useful to apply a splint which will keep the arm raised above the head with the forearm fully supinated.

In the majority of cases, complete or almost complete recovery of power takes place within two or three months. In many, however, the improvement proceeds more slowly, and yet the child entirely recovers. In many instances, although no actual paralysis is left, the deltoid and supra- and infra-spinati remain weak. An important part of the treatment consists in the patient encouragement of any possible voluntary movement of the paralysed muscles, even the slightest; and the child should be tempted in every way to try to move the limb.

When no improvement is noticed within three months, especially in cases of the lower arm type, a surgical operation may sometimes be recommended to remove the cicatrised portion of the injured nerves and bring the uninjured parts together. The advisability of such an operation is a difficult question in view of the surprising amount of spontaneous improvement which very frequently occurs even at a late date, and because, in severe and long-standing cases in which no improvement has occurred, the damage present is generally so extensive that the uninjured parts of the nerves are too far separated from one another for it to be possible to bring them together. In doubtful cases, however, the operation should be tried, for it is not a dangerous one in the hands of a competent surgeon.

Cerebral Birth Palsies.

Injuries to the brain during labour are more common than serious lesions of the nerves. In most of the cases in which these occur, the cerebral injury is said to be secondary to a **meningeal hæmorrhage**.

The lesion may be due to pressure by the maternal parts on the head, or to that of the forceps and other artificial means used to expedite delivery. According to Dr Herbert Spencer,[1] "Cerebral hæmorrhage is more frequently found in still-born children delivered by the forceps than in those born by the breech, and in the latter more frequently than in those born naturally by the head." It is relatively rather more frequent in first than in later-born children. In premature infants, it not uncommonly occurs even when very little force has been used in the delivery.

Symptoms.—Children who are the subjects of this lesion are often apparently still-born, and only come round after prolonged artificial respiration. Many of them have convulsions during the first few days of life. As they grow older, it is found that they are paralysed. In well-marked cases a distinct rigidity of the lower limbs may be early noticed, and the arms also are very stiff. The infant has an unnatural difficulty in grasping objects, and, when he has grasped them, in letting them go. The parents, however, often notice nothing wrong with him until attempts are made to induce him to stand and walk.

The symptoms vary according to the situation of the lesion. In the great majority of cases the paralysis takes the form of *spastic diplegia*, and affects both sides and both upper and lower limbs, although often one side is more severely affected than the other, or the legs more markedly than the arms. Occasionally the paralysis is unilateral, and sometimes there is no ascertainable affection of the arms. When the anterior lobes only are affected, there may be mental deterioration alone and no paralysis of the limbs. In severe cases the whole body is often more or less rigid. The hip joints are extended so that the child cannot sit, and the knees tend to cross one another from adductor

[1] "On Visceral Hæmorrhages in Still-Born Children," *Trans. Obstet. Soc. London*, 1891, xxxiii., 203.

spasm (Fig. 165). The knee joints are usually slightly bent, the feet pointed, and the toes dorsi-flexed.

Although the muscles of the limbs feel hard, they are generally small in bulk. In a considerable proportion of cases, athetotic or choreic movements develop in the upper limbs. The knee-jerks are sometimes got with difficulty, because the extreme muscular rigidity prevents all sudden movement. Often, however, they are much exaggerated. Well-marked

FIG. 165.—Spastic Diplegia with mental defect from cerebral hæmorrhage at birth. Girl of 7½ years.

ankle clonus is rare. The plantar reflex shows a distinct extensor response.

The facial muscles often overact when the child speaks, so that he grimaces in an exaggerated way. In a large proportion of the cases there is strabismus. The speech is slow in being acquired, and is usually guttural and badly articulated. As the patient gets older, his head is noticed to be relatively small, owing to the growth of the damaged brain not keeping pace with that of the rest of the body.

The mental condition of these children varies greatly

according to the degree and position of the cerebral injury. In many it is profoundly affected, in others very slightly. Often, however, it will be found that children with lesser degrees of spastic diplegia are more intelligent than their vacant expression and exaggerated facial movements would have led one to expect (Chapter XXXII.).

Diagnosis.—The diagnosis of cerebral birth palsy depends on the early appearance of the symptoms and the history of a complicated labour. In slight cases when no clinical history is obtained, there may be considerable difficulty in being sure of the diagnosis. In early infancy, care must be taken not to mistake an unusual degree of the normal physiological hypertonicity of the limbs for this condition.

Cases of paralysis due to intracranial hæmorrhage at birth show little change during the early years of life. It is only when the child is old enough to exert his will strongly in moving his stiff limbs, that decided improvement may be looked for; and it can *never* be very great, owing to the permanently spastic condition of the muscles.

Treatment.—When convulsions recur from time to time, sedatives and tonics may prove useful. For the paralysis, however, neither medicine nor electrical treatment is really of any use. Considerable improvement may follow the persevering use of passive movements and regular exercises. In cases in which the mental faculties are not severely affected, a good deal may sometimes be done by surgical measures to improve the child's condition. These consist mainly in division and lengthening of the adductors of the thighs. Section of the posterior nerve-roots has recently been practised, with improvement in a few cases. As yet, however, this operation has not been generally successful, and at best it is rather a dangerous proceeding. If the patient is deficient in intelligence and in will power, the result of any operation is sure to be disappointing.

Paralyses Setting in during Infancy and Childhood.

Paralysis arising in childhood may be due to lesions of the nerves, of the spinal cord, or of the brain.

Peripheral Paralyses.

Facial Paralysis.—In Scotland, far the commonest cause of facial palsy in infants and young children is destruction of the

facial nerve, due to tuberculous otitis which has spread into the Fallopian canal. In places where bovine tuberculosis is less prevalent than in Edinburgh, this form of paralysis is not nearly so common.

Its onset is an urgent indication for surgical treatment of the ear; and the outlook as to recovery of the facial palsy is very bad, for the destruction of the nerve is usually so complete that we cannot expect any treatment—electrical or other—to be successful. In the course of years, however, if the patient survive, the deformity is materially lessened by the gradual contraction of the paralysed muscles.

In rare instances, ordinary acute otitis media may cause facial palsy from pressure on the nerve. In these cases the paralysis recovers as the otitis subsides.

In older children we sometimes meet with ordinary *Bell's paralysis* from exposure to cold. This usually recovers in a short time. The treatment is the same as in adults.

We must also bear in mind that paralysis of the face occurs in acute poliomyelitis, usually along with paralysis elsewhere, but occasionally it is the only lesion. It generally ends in complete recovery.

Facial paralysis of the peripheral type is also met with as a symptom of intracranial disease, especially of tuberculous meningitis and cerebral tumour.

Peripheral Neuritis.—Severe multiple neuritis of the extremities occasionally occurs as a sequel to various infectious diseases such as influenza, measles, whooping-cough, and enteric fever. It is usually symmetrical in its distribution, affecting both arms, both legs, or all four extremities. It is often, but by no means always, characterised by a degree of sensory as well as motor paralysis, and there may be tenderness along the course of the affected nerves. There is more or less definite reaction of degeneration, and usually loss of the deep reflexes.

The distal portions of the extremities are generally first and most severely affected. The muscles most severely paralysed are usually the extensors of the foot and hand, the peroneal and musculo-spiral nerves being especially liable to be affected.

The treatment consists mainly in keeping the parts warm, and improving the general strength by careful feeding and tonics, especially cod-liver oil; and later in massage and

exercises. If pain is severe in the early stage, local heat may be applied and sedatives given.

In many cases complete recovery takes place, but in some the limb is crippled by permanent contractures (Fig. 166).

Peripheral neuritis is also met with as a symptom of poisoning by arsenic and lead.

Lead Palsy.—Paralysis from lead poisoning is not common in children in this country, but must always be remembered in examining obscure cases.

The onset of the *symptoms* is often gradual and insidious. There may be a history of lead colic. The blue line on the gums is absent in more than half of the cases.[1] The chief

FIG. 166.—Deformity from Peripheral Neuritis, which followed measles in a boy of 6 years. Fifteen years later, only slight improvement had taken place.

peculiarity of lead palsy in childhood is its tendency to affect the lower limbs earlier and more severely than the upper. The usual drop-wrist is, however, seen in some cases, but generally later than the affection of the legs. The excitability of the muscles to galvanism and faradism is much diminished, but there is no reaction of degeneration. The knee-jerks and plantar reflexes are abolished. In some cases the diagnosis may be confirmed by the discovery of lead in the urine.

The *treatment* consists in rest, in encouraging the various excretions, in administering iodide of potash, and in using massage and electricity to the paralysed limbs.

[1] G. Variot, "Intoxication Saturnine," *Grancher et Comby, Traité des Maladies de l'Enfance*, t. i., 1008.

The *prognosis* is usually good if the treatment is begun early.

Post-Diphtheritic Paralysis.—Diphtheritic palsy not uncommonly follows a slight sore throat which has not been recognised as diphtheritic in origin; and its nature is therefore apt to be overlooked.[1]

The *symptoms* are very characteristic and may set in within a week of the onset of the throat affection. Generally, however, they do not appear until between the second and fourth, and sometimes not till the sixth or eighth week after the disappearance of the false membrane. The part earliest and most frequently affected is the soft palate; and its implication leads to nasal speech, and often to return of fluids through the nose during drinking. Later, the pharynx and œsophagus may also be paralysed, and the child is then unable to swallow, and coughs and splutters when he tries to do so. Paralysis of accommodation is often added, so that the patient is unable to read small print or to thread a needle. In some cases a slight squint occurs leading to double vision. Ptosis is not uncommon.

There is often more or less paresis of the lower limbs, less commonly of the upper, and of the muscles of the back and neck; but complete paralysis does not occur. The paretic state of the lower extremities may account for the unsteadiness in walking which is often present; but sometimes there is also a degree of ataxia of both upper and lower limbs, and, rarely, this may be so severe as to suggest the possible presence of cerebellar disease. The knee-jerks are lost early in most instances, though not in all; and they may not be regained for many months. Their early return is a very good sign. Sensation is generally little, if at all, affected; but in a few cases there is severe pain on movement of the legs. Rarely, there is severe and long continued wasting of the muscles.

Paresis of the muscles of respiration is a very characteristic and serious manifestation of the disease. It is generally preceded by affection of the palate and is often accompanied by pharyngeal palsy. Paresis of the diaphragm is recognised by observing the respiratory movements of the abdomen. When its action is normal, the downward movement of the

[1] F. E. Batten, "Diphtheritic Paralysis," *Garrod, Batten, and Thursfield's Diseases of Children*, London, 1913, 826.

diaphragm causes a bulging of the upper part of the abdominal wall with each inspiration; but, when it is weakened by disease, this does not occur, and there may even be a marked indrawing in this situation. The respiratory paralysis is, of course, a threatening symptom while it lasts; but fortunately it is usually of short duration; and most cases recover, if the accompanying interference with swallowing is treated early by the use of tube feeding, so as to prevent the occurrence of inhalation-pneumonia and bronchitis.

Paralysis of the heart is the manifestation of post-diphtheritic paralysis which gives rise to most anxiety. It is indicated by a feeble and irregular state of the pulse and the disappearance of the first sound at the apex; sometimes also by curious and complicated cardiac murmurs. It often takes place without any other form of paralysis being present; and is not infrequently fatal unless the greatest care is taken. In the worst cases vomiting usually occurs, and is, therefore, always to be regarded as a very serious indication.

Diagnosis.—The distribution and gradual onset of post-diphtheritic paralysis are so peculiar that there is rarely any difficulty in recognising the condition. Ocular and palatal paralysis from tumours of the pons and medulla are always accompanied by other indications of intracranial disease. In acute poliomyelitis, the loss of power is less general and more complete. Paralysis of the muscles of respiration as an isolated phenomenon seems to be produced almost invariably by the toxin of diphtheria. Sometimes, indeed, the throat seems healthy and no diphtheritic organisms are to be found. In these cases, however, it is always probable that the infection may have been present in one of the other mucous membranes.

Prognosis.—Diphtheritic paralysis usually lasts for from six to eight weeks or a little longer; but it may take many months before the patient is quite well. The weakness of the heart is sometimes very slowly recovered from. The disease *always* tends to recover, except in those cases in which there is heart failure, or where serious complications result from interference with respiration or with swallowing. I have seen one case which made a good recovery from an attack of acute pneumonia; but the crisis took place on the third day.

It is only in very exceptional instances that any permanent local paralysis is left.

Treatment.—Good nursing is the one really important factor in the treatment of post-diphtheritic paralysis. To lessen the risk of heart failure, the child should be put to bed at once, and kept lying quite flat without even a pillow under his head; and he must not be allowed to sit up *for any purpose whatever.* Food should be given mostly in a liquid form, in small quantities, and at frequent intervals. If the palate is paralysed, the fluids should be thickened by some farinaceous addition; and the child must be fed with great care to avoid choking. Whenever a distinct difficulty in swallowing occurs, recourse must be had at once to nasal feeding (p. 815). Many children recover when fed in this way who otherwise would have certainly died in a few days. The bowels must be carefully regulated.

The drugs usually given are atropin and strychnine. Batten recommends strongly the subcutaneous injection of $\frac{1}{200}$ gr. of the former and $\frac{1}{120}$ gr. of the latter every four hours. He believes that this has a most valuable effect in warding off respiratory and circulatory failure. Alcohol should not be given as a matter of routine, but is often useful when there is evidence of cardiac failure. Electricity is of no use and may do a great deal of harm by exciting the patient.

Spinal Paralysis.

Paralysis of spinal origin occasionally occurs in children as the result of tumour, hæmorrhage, transverse or disseminated myelitis, or, in Pott's disease, from compression myelitis. Various forms of progressive muscular atrophy with a spinal lesion, Friedreich's ataxia, and other rare types of spinal paralysis also develop in childhood. Far the most important disease of the spinal cord that is met with in children, however, is *acute poliomyelitis*, or infantile spinal paralysis, as it used to be called (Chapter XXX.).

Paraplegia from Spinal Caries.—In its advanced stages, spinal caries may fairly be claimed as a surgical condition. Early cases, however, before either curvature or suppuration has occurred, are usually taken first to the physician, and he must always investigate the state of the spine in any case in which there is weakness of the lower limbs, or obscure pain in them or in the abdomen. When the diagnosis is

doubtful, an X-ray examination should *invariably* be made; and even in obvious cases a plate should be taken before treatment, for future reference.

Paraplegia from spinal disease generally begins most insidiously, and is apt to be overlooked or misinterpreted for a long time. The child, who has generally been falling-off for some time previously, begins to show a disinclination for exertion and is much more easily tired than he used to be. He often, indeed, denies having any pain; but generally his expression and movements show clearly that he is really suffering considerably. The weakness continues to increase, and at night there may be enuresis, or starting movements of the legs. When he goes about, the child is noticed to hold his back stiffly, and to walk circumspectly as if he were afraid of a sudden jar. At this stage there may be no sensory changes, and little or nothing else to be made out on examination of the limbs. Usually, however, we find an extensor response, exaggeration of the knee-jerks, and perhaps slight ankle-clonus; and, although no curvature may be discoverable as yet, the spinal column is found to have lost the easy freedom on passive movement which is characteristic of perfect health in childhood. Later, more pronounced symptoms of spinal caries develop, and some degree of angular curvature generally appears.

In most of the cases of spinal caries in which paraplegia occurs, the disease is situated in the upper dorsal region; for, at this level, the spinal canal is at its narrowest and the cord therefore in special danger of being compressed. When this begins, the lower limbs become spastic and the knee-jerks exaggerated, and the patient may lose control of the bladder and bowel. In older children a girdle-pain is sometimes complained of.

When the lumbar region is the part affected, there is less likely to be deformity, and the knee-jerks may be abolished instead of being increased. If the cervical spine is diseased, there is apt to be wasting of the hand muscles as well as spasticity of the lower limbs.

Treatment.—The patient must be kept lying, with or without extension, and his spine rendered immobile by the use of some kind of splint. For this purpose a wooden frame may be used consisting of a double long splint with transverse

bars; but a Bradford frame is better, and a Whitford's modification of the Bradford frame probably best of all. The quality of the nursing is, however, even more important than the form of the frame. This kind of treatment is generally very successful, but it must always be persevered in for a year at least; and often eighteen months or two years may be necessary before the child can be safely allowed to get up and go about in some sort of stiff jacket. During the treatment, the patient should be kept in the fresh air as much as possible, in his frame, and should sleep in an open-air shelter. It is well, if possible, always to ascertain the progress of the healing process in the vertebræ by an X-ray examination, before the child is allowed any increase of movement.

Cerebral Paralysis.

Paralysis from brain lesion is probably even commoner in childhood than that from disease of the spinal cord. It is met with as one of the symptoms of tuberculous meningitis, of tumour, of abscess, and of syphilitic and other diseases of the brain. There is also a class of cases of cerebral paralysis which, although they may be due to a variety of cerebral lesions, resemble each other closely in their symptoms.

Infantile Cerebral Paralysis.—As their cause cannot usually be determined during life, these cases are best referred to as infantile cerebral paralysis or as infantile hemiplegia—the paralysis being nearly always unilateral.

According to Osler,[1] "Infantile hemiplegia is commonly the result of a variety of different processes, of which the most important are—

"1. Hæmorrhage occurring during violent convulsions or during a paroxysm of whooping-cough.

"2. Post-febrile processes: (*a*) embolic; (*b*) endo- and peri-arterial changes; and (*c*) encephalitis.

"3. Thrombosis of the cerebral veins."

It seems probable, however, as Strumpell long ago pointed out, that many acute cases of infantile hemiplegia are the result of *polioencephalitis* due to the same infection as the poliomyelitis which is responsible for infantile spinal paralysis. A number of them, however, especially those due to vascular lesions, occur

[1] *The Cerebral Palsies of Children*, 1889, 96.

in the course of infectious illnesses such as measles, scarlet fever, or diphtheria, or follow toxic diarrhœa.

The onset of the *symptoms* in infantile cerebral paralysis is generally sudden and is usually, although not always, accompanied by convulsions or coma. Often there is considerable rise of temperature, and occasionally vomiting. Rarely, the paralysis is slight at first, and after repeated convulsive attacks becomes more complete; generally, however, it is complete from the beginning. The face is often, but not always, affected. After the acute symptoms have lasted a varying number of days, they gradually subside and the extent of the paralysis becomes evident. At first, the paralysed limbs are flaccid, but in a few days rigidity sets in. In some cases, the paralysis gradually and entirely passes off, but, in the great majority, a more or less severe degree of rigidity and powerlessness is left.

FIG. 167. — Infantile Cerebral Paralysis. Boy of 2½ years.

The arm is generally more completely paralysed than the leg, and the forearm becomes more or less fixed in the prone position (Fig. 167). The muscles are not usually much atrophied, but they are generally in a state of more or less rigid contracture. Rigidity, however, is not quite so prominent a feature in these cases as it is in those of cerebral diplegia. The leg recovers to a greater extent than the arm, and occasionally, as already mentioned, no trace of the paralysis remains.

The deep reflexes are almost invariably increased. Sensation is usually quite unaffected. In a considerable proportion of cases there are choreic or athetotic movements. Aphasia is quite often found in cases of left as well as in those of right hemiplegia, but is never permanent. Mental defects and eccentricities are common. Epileptiform seizures often occur; they may be of the nature of petit mal, or general convulsions with unconsciousness, but sometimes they consist in unilateral spasms without loss of consciousness.

The *diagnosis* of the lesion in these cases is usually exceedingly difficult at first. It is generally, however, tolerably easy to distinguish between them and cases of poliomyelitis. The main points of difference are given as follows by Sachs:[1]—

Acute Spinal Paralysis	Acute Cerebral Paralysis
Onset sudden with fever, coma, and convulsions. Convulsions rarely repeated after first few days.	Onset sudden with fever, coma, and convulsions. Convulsions apt to be repeated.
Paralysis flaccid, associated with atrophy.	Paralysis spastic; no atrophy; associated with rigidity and contractures.
Paralysis widely distributed, possibly involving all extremities, or narrowly limited to one member, or even a single group of muscles.	Paralysis generally hemiplegic, sometimes diplegic or paraplegic; monoplegia rare.
Electrical reactions altered (R. D.).	Electrical reactions normal.
Deep reflexes diminished or lost.	Deep reflexes exaggerated.
Intellect never permanently involved; no epilepsy.	Intellect often involved; epilepsy frequent.

The *prognosis* is almost always unfavourable. In rare cases, especially those due to hæmorrhage (such as occasionally occurs in the course of an attack of purpura), there may be a complete recovery of power. In most cases, however, only slight improvement, if any, is observed. In some cases, even when convulsions have not been present at the onset, the damage to the brain predisposes to their later occurrence; and in cases where the intellect is not seriously affected from the first, there is apt to be a tendency to mental defect or peculiarity in later life.

This form of paralysis, after the first few weeks, should be *treated* mainly by active and passive exercises. If energetically persisted in, these certainly lead to some improvement. Massage is of little or no use. It is with stiffness and lack of control of the muscles and not with weakness that we have to do.

In this class of diseases, as well as in infantile spinal paralysis, very great improvement sometimes results from suitable surgical measures.

Intracranial Tumours.

About half of the intracranial tumours in childhood which produce symptoms are of the nature of caseating tuberculous

[1] *The Nervous Diseases of Children*, 1895, 305.

masses. The majority of tuberculous nodules in the brain in early life, however, are quite latent—they produce no symptoms and are only discovered after death. The other varieties of intracranial tumour found in childhood are gliomata, glio-sarcomata, sarcomata, endotheliomata, and gummata. The first mentioned of these is the commonest, and the last two are very rare. They are all of them uncommon during the first two years of life.

There is a marked difference between the usual position of intracranial tumours in children and in adults (James Taylor).[1] In early life the great majority are situated below the tentorium; while after sixteen the conditions are reversed, and supra-tentorial are much commoner than infra-tentorial tumours. This does not apply to the above-mentioned latent tuberculous nodules, which are often found in the cerebral cortex in infants.

The **causation** of intracranial growths is quite obscure, but there seems no question that in some cases they are set up by an injury.

Symptoms.—The three cardinal symptoms of intracranial tumours—*headache*, *vomiting*, and *optic neuritis*—are generally present. The headache is a fairly constant feature, though it is relatively less severe in children than in adults. Vomiting and optic neuritis are sometimes both absent. The occurrence of general *convulsions* is sometimes the first indication of the presence of a cerebral tumour, and the attacks may go on recurring for a long time without any more definite symptom appearing. At various later stages of the disease, also, convulsions are apt to occur. *Nystagmus* is a common symptom, and *giddiness* and *mental dullness* are also common. Secondary *hydrocephalus* often sets in, especially if the tumour is so situated as to obstruct the aqueduct of Sylvius or the fourth ventricle.

In the majority of cases of intracranial tumour in children, only general symptoms are present, such as the above-mentioned. In many, however, localising symptoms also occur. In young children these are often very difficult to make sure of.

Lesions of the hemispheres are less likely to produce localising symptoms in children than in adults. This is because the functions of the various areas of the cortex are as yet incompletely differentiated, and they are therefore more ready

[1] *Nervous Diseases in Childhood and Early Life*, London, 1905, 165.

to take up the work of neighbouring parts when these are damaged by disease. One result of this compensatory action of the other cortical areas is that aphasia is almost unknown in children as a symptom of cerebral tumour.

Cerebellar tumours are specially important because they are relatively common in childhood. They give rise to the same symptoms as in later life, such as vomiting, headache, optic neuritis, and ataxia of the side next the lesion, with normal deep and superficial reflexes. The attitude of the head which is found in these cases is often peculiar and characteristic (Fig. 168). Batten describes it as follows:—"The ear on the side of the lesion is approximated to the shoulder of the same side, and the side of the face corresponding to the cerebellar lesion is turned upwards, and the chin is diverted to the same side." It is characteristic of the symptoms of cerebellar tumours that they are apt to vary considerably in severity from time to time.

FIG. 168.—Attitude of head in Cerebellar Tumour.

The **prognosis** of intracranial tumours is extremely bad in almost all cases. The course of the disease varies in different instances. Sometimes in tuberculous and gliomatous tumours it may be very chronic, and—with or without treatment—temporary arrest of the symptoms is not uncommon. Occasionally, cases—especially cerebellar cases—about the diagnosis of which there seems no doubt, entirely recover. In gliomata the symptoms are usually more rapidly progressive and more severe, and hæmorrhages into the substance of the growth are apt to occur. Cases of tuberculous tumour often end in tuberculous meningitis.

The **diagnosis** depends on the presence of the characteristic symptoms. The mistake most often made by young practitioners is to regard the facial and other paralyses of

commencing tuberculous meningitis as localising symptoms of a cerebral tumour.

Treatment.—It is customary in cases of intracranial tumour to begin the treatment by the administration of iodide of potash and mercury in full doses. Should the tumour chance to be syphilitic, this treatment will have a great effect. Even when it is not so, however, distinct improvement occasionally follows the use of these drugs.

Another line of treatment which I have once or twice found surprisingly successful consists in the use of very active anti-tuberculous measures. If we can succeed in obtaining a rapid and decided gain in weight and vigour in a child with a tuberculous tumour by keeping him in the open air, greatly improving his diet, and administering cod-liver oil, the characteristic symptoms may gradually lessen and he may recover almost, if not quite, good health. Unfortunately, it is only rarely that such a result can be obtained.

Removal of the tumour by surgical operation is very rarely possible. In some cases, however, when the pain is severe, trephining may afford marked relief. The headache may also in many cases be greatly diminished by the use of such drugs as antipyrine and phenacetin, and especially by the combinations of these with caffein. Should these fail, full doses of morphine may be tried. Alcohol must be avoided, as it tends to increase the pain.

The same remedies that relieve the headache have sometimes a good effect on the vomiting.

Functional Paralysis.

The first symptom which is noticed in some cases of chorea is a gradually developed inability to use one arm. This is sometimes mistaken for commencing paralysis from organic disease, but the loss of power is never complete. In some severe cases of chorea also, the paretic element is so much more prominent than the involuntary movements or the incoordination that the patient is apt to be regarded as suffering from some form of paralysis. Very little care, however, will prevent this mistake.

Hysterical paralysis sometimes occurs even in young children, and it is not uncommon in girls of ten or twelve or older.

CHAPTER XXX

ON ACUTE POLIOMYELITIS AND ENCEPHALITIS LETHARGICA

Acute Poliomyelitis (*Infantile Spinal Paralysis*).

THE first thorough descriptions of acute poliomyelitis were published in 1840 by v. Heine[1] and in 1887 by Medin,[2] and on the Continent the disease is often called after these observers (Heine-Medinische Krankheit). Much literature has since appeared on the subject, an excellent summary of which will be found in F. E. Batten's "Lumleian Lectures."[3] During the last few years, the extensive epidemics, in America and elsewhere, have produced a large amount of valuable literature.[4]

Epidemiology.—Until toward the end of last century, the disease was regarded mainly as one which occurred sporadically; but, even in 1840, Heine seems to have noted its occasional occurrence as an epidemic and to have suspected its possible spread by infection. In 1868, there was an epidemic in Norway.

The first epidemic, however, to be fully recorded was one in Sweden in 1881. In 1883, small groups of cases were observed in Norway, Germany, and France, and in 1887 Medin gave a full account of a small outbreak in Stockholm. During the "nineties," small epidemics were reported in Italy, France, Australia, England, America, Austria, and Sweden (Wickman[5]). Between 1900 and 1910, the disease occurred

[1] Jac. v. Heine, *Spinale Kinderlähmung*, Stuttgart, 1840.

[2] O. Medin, *Proc. 10th Internat. Med. Congr.*, 1891, ii., div. vi., 37.

[3] *Brain*, 1916, xxxix., 115.

[4] G. Draper, *Acute Poliomyelitis*, London, 1917; and J. Ruhräh and Erwin E. Mayer, *Poliomyelitis in all its Aspects*, Philadelphia and New York, 1917.

[5] Wickman, *Beiträge zur Kenntniss der Heine-Medinische Krankheit*, Berlin, 1907.

in large epidemics in various parts of Europe, in North and South America, in Australia, and in the South Sea Islands. In these, the numbers affected ran into four figures; while, in the former outbreaks, a few dozen cases at most had been reported.

In 1904, Wickman made the very important observation that the disease often occurred in an abortive, non-paralytic form and that these cases, being usually unrecognised, were possibly a common cause of the spread of the disease.

Between 1903 and 1907, poliomyelitis seems to have been pandemic in Scandinavia; and, from 1907 to 1910, large epidemics occurred in New York State and in Massachusetts.

In this country the prevalence of the disease has hitherto been mainly sporadic, but it has not been very rare to meet with two or even more cases in one family. Occasionally small epidemics have been reported. One of the more severe of these, in which sixty-two cases were collected, occurred in Edinburgh and the surrounding counties in 1910.[1]

As further and larger outbreaks will probably occur in this country, it is important to study the spread of the disease and such factors as have been common to previous epidemics.

Seasonal Incidence.—In the Northern Hemisphere, the disease appears mainly between July and October; in the Southern, it is generally met with in March and April. In the Tropics, its time of incidence has varied; it occurred in Cuba in 1909 in July and August, and also, very severely, in an island in the South Pacific in January of the same year.

Age Incidence.—Poliomyelitis is rare in early infancy. It mainly affects children during the second and third years; the numbers diminish steadily in later childhood, and cases in adults are comparatively rare.

Mortality.—This varies in different epidemics, and also according to the extent to which abortive cases are included in the statistics. It is said to be, on an average, about 11 to 12 per cent.; but in a recent New York epidemic it was 27 per cent., even although the statistics included more non-paralytic cases than those of any former epidemic (Draper). The mortality is higher in adults than in children.

The duration of the *incubation* shows considerable variations. In the human being, it generally lasts less than four days, and

[1] H. Bruce Low, *Proc. Roy. Soc. Med.* (Epidemiol. Sect.), 1912, vol. v., 76.

sometimes as much as a week or even more. A fortnight should be allowed for quarantine. In experimental animals, it is usually from eight to ten days, but it may be much longer.

Spread of Infection.—Wickman showed that the spread of the disease by carriers usually follows the lines of communication (roads and railways), and that it is favoured by school attendance. The carriers may be entirely free from disease of any kind.

Experimental Work.—Great advances in our knowledge of the subject have resulted from experimental investigation.[1] In 1908, Landsteiner and Popper succeeded in infecting a monkey by the injection of substance from a human spinal cord. In the following year, Flexner, Lewis, and various Continental observers showed that the disease could be transmitted from one monkey to another by injection of an emulsion of a diseased spinal cord. In 1913, Flexner and Noguchi were able to cultivate its apparent cause[2]—an ultramicroscopical organism, which retained some of its virulence even after it had been passed through the finest known filters. They found that it could be preserved in glycerine, in a state of activity, for many months, that the infection was able to penetrate the uninjured mucous membrane of the nose and bowel, and that flies could transmit it. The finality of Flexner's conclusions has recently been questioned, and the matter is still *sub judice*. In this disease, however, as in the case of epidemic cerebro-spinal meningitis and encephalitis lethargica, the ways in which the infection spreads are still obscure.

Pathological Anatomy.—When the central nervous system of experimental animals with poliomyelitis is examined, inflammatory infiltration with œdema, and sometimes hæmorrhages, are found round the blood-vessels in the spinal meninges. Similar changes are present in the grey, and to a less extent in the white, matter of the cord. The anterior horns are chiefly affected, and their large ganglion cells are often degenerated and necrosed. The necrosis is probably due partly to a direct toxic action, but the great interference with their blood-supply, owing to the inflammatory exudation, may

[1] F. E. Batten, "Polioencephalitis and Poliomyelitis," *Trans. 17th Internat. Congr. Med.*, London, 1913, sect. x. (Dis. of Children), 145.

[2] *Journ. Exper. Med.*, Oct. 1913, xviii., 461.

also be partly responsible for it. The necrosed cells are found to be invaded by phagocytes ("neurophages"). The posterior nerve roots are always affected. Corresponding changes may be found in the medulla, and occasionally in the pons and crura cerebri. The cerebrum is the portion of the central nervous system least frequently implicated. In cases infected by intravenous injection, the blood-vessels are more seriously damaged than in those in which the inoculation has been made directly into the brain.

In human beings, the lesions closely resemble those found in monkeys that have been infected by intracranial inoculation.

Although the principal lesions are found in the nervous structures, widespread although less severe changes have been described in other viscera. These include hyperplasia of the lymphatic glands and spleen, changes in the bone-marrow, interstitial small-cell infiltration in the portal spaces in the liver, and general cloudy swelling of the organs.

Symptoms.—In acute poliomyelitis the clinical manifestations may vary considerably, and a classification of the cases into different types may be made, either according to the parts of the nervous system involved, as shown by the symptoms, or by the peculiarities of the onset and course of the symptoms themselves. In the former, *pathological*, variety of classification, the cases may be divided as Wickman proposed into types, according as their symptoms indicate chiefly involvement of (1) the *spine;* (2) the *medulla, pons, and mid-brain;* (3) the *cerebrum;* (4) the *cerebellum;* (5) the *meninges;* (6) the *nerves;* and, lastly, there is a large group of *abortive cases*, in which there is no paralysis at all. Such a classification is certainly useful, although it may be open to criticism on various grounds.

An interesting and instructive *clinical* classification is proposed by Draper, in which the cases are divided into three groups, according to the nature of their onset and their clinical course. In one of these—the *sudden onset group*—the meninges and nervous tissues are evidently affected from the first. Another he calls the *dromedary group*, because in them an initial rise in temperature with general symptoms is followed, after an intervening apyrexial interval, by a second rise or "hump" with nervous manifestations. These cases were formerly described by Sir Thomas Barlow as "jump cases." In the third and last type—the *straggling group*—

the symptoms are like those of the dromedary cases, except that in them there is no intervening interval of well-being between the first and second acute periods.

(1) *The Common or Spinal Form.*—As the spinal group of cases is much larger than all the other paralytic groups put together, we may begin by describing its clinical manifestations, as they occur in an ordinary case of the *sudden onset type.*

In many of the cases we are told that the child has gone to bed quite well and has wakened in the morning unable to move a leg or an arm. Often, however, we find, on close inquiry, that for a day or two before this occurred, there have been some slight indications that the child was not quite as well as usual. In the commonest and most typical of these cases, the onset differs little, at first sight, from that of most other acute infectious diseases. In the midst of perfect health, the child becomes feverish, drowsy, and restless, and complains of headache; the temperature goes up to 101° to 103° F., and there may be vomiting or diarrhœa, a sore throat, or a convulsion. Although the general symptoms are so like those of other feverish ailments of childhood, there is often, as Draper points out, a peculiar character in the symptoms which may suggest the real nature of the attack to those who have seen many cases. The eyes look somewhat puffy and have a glazed appearance, and the patient is nervous and very irritable; he is extremely anxious to be left alone and resents being touched or even spoken to. A very characteristic symptom consists in tenderness on any forward movement of the spine. This leads the child to keep his back very stiff, and to resent strongly any attempt to bend the neck or body. Along with this, there is often a well-marked Kernig's sign with resistance and tenderness on movement of the limbs, and sometimes a definite degree of opisthotonos develops. This stiffness occurs before there is any implication of the meninges. Draper suggests that the pain on bending the spine may be due to the intervertebral spinal ganglia being pulled on by this movement. On physical examination, nothing definite is found except a furred tongue and some redness of the fauces. Apart from the general irritability and stiffness, there is usually no sign of the nervous system being affected at this stage.

The spread of the disease to the meninges is indicated by severe headache, or by disturbance of the tendon reflexes. Occasionally there is swelling of the joints of the affected limbs, and transitory erythematous or other rashes may be present.

The paralysis, in the great majority of cases, is complete at a very early stage of the illness in this type, within the first twenty-four or forty-eight hours, or at latest by the third or fourth day. After a few days or weeks, there is generally more or less noticeable recovery of power in some of the muscle-groups affected. Within about two months of the beginning of the attack, very marked wasting of the affected limb is evident, along with lowering of its temperature; and, within a week of the onset, reaction of degeneration may be demonstrated. When the paralysis is severe and extensive, the whole of the affected limb, including the bones, often ceases to grow at the same rate as the others.

FIG. 169.—Poliomyelitis of right arm.

The *distribution* of the paralysis varies in different cases. Most frequently the disease affects one lower limb only, but often both are paralysed. Sometimes all the limbs are affected, sometimes one arm and one leg, and sometimes one arm only (Fig. 169). It is rare for the arm and leg of the same side to be affected. In some cases there is marked implication of the muscles of the neck and back, and occasionally those of the abdomen are severely paralysed. When this occurs and the weakness persists, a peculiar bulging of the abdominal wall occurs when the child cries (Fig. 170). In a few cases the facial muscles on one side are paralysed along with one or more limbs, and occasionally the face is the only part affected. This form of facial paralysis practically always recovers rapidly.

The other pathological types are all very much rarer than the spinal.

In the "*dromedary type*" of case, as already mentioned, the first period of fever is followed by an apyrexial interval which is succeeded by a second rise of temperature. The name is now also applied to cases in which the two periods of acute symptoms are unaccompanied by corresponding "humps" on the temperature chart. The duration of the "humps" varies from a few hours to several days, and their severity also varies greatly — being extremely slight in some instances and in others severe. The symptoms during the second "hump" in this type are due to the involvement of the nervous system, and correspond exactly to those during the onset in the sudden onset cases in which the virus has found its way rapidly into the nervous tissues. Those during the first "hump" are caused by the general systemic infection, including probably infection of the spleen and bone marrow. When they are mild in character, they are very apt to be overlooked or forgotten by the parents.

FIG. 170.—Poliomyelitis of abdominal muscles. Showing bulging during crying.

Following the complete remission of the symptoms in the first group or their varying duration in the second, the patient may go on to recovery, or he may suddenly develop signs of

involvement of the nervous system; and, when this occurs, the case may end either in recovery or in continued paralysis.

In the "*straggling type*" of cases, the onset and course of the symptoms are the same as in the group just described, the only difference being that in them there is no apyrexial interval between the "humps." The original dose of the virus has either been larger or more intense, or else the child's resistance has been lower than in the other type, so that the indications of a general infection continue until the nervous system has become affected.

The other five paralytic varieties of acute poliomyelitis are all more or less rare. They may occur in an uncomplicated form, but are often accompanied by spinal symptoms.

(2) *The Bulbar and Pontine Form.*—In this rare type any of the cranial nerves may be involved, especially the facial.

(3) *The Cerebral Form.*—When the brain is affected, the symptoms vary according to the part of the hemisphere implicated. If the frontal region has been attacked, the child shows symptoms of severe mental deterioration such as senseless screaming, failure to recognise his parents, dirty habits, and unintelligible speech. If the disease is in the motor areas, hemiplegia or diplegia may be produced; and if the occipital cortex is the part involved, cerebral blindness follows, which may or may not be recovered from.

(4) *The Cerebellar or Ataxic Form.*—This leads to ataxia of the cerebellar type which sets in with cerebral symptoms, and may either be unilateral or involve both sides. The intellect is not affected, and there is no loss of muscular power. Nystagmus may be present. These symptoms, like those of the other forms, may be permanent or may recover entirely.

(5) *The Meningitic Form.*—In some cases of poliomyelitis there are symptoms which are indistinguishable from those of meningitis — such as headache, coma, head-retraction, Kernig's symptom, and convulsions—and the characters of the cerebro-spinal fluid also suggest involvement of the meninges. Complete recovery may, or may not, occur after a short illness.

(6) *The Neuritic Form.*—Some writers on infantile paralysis have been of opinion that a few of the cases that looked like poliomyelitis may have really been caused by affection of the

spinal nerves. This seems quite possible, but it has not yet been proved. Occasionally instances of evident neuritis have occurred, along with cases of distinct poliomyelitis in other members of the same family.

(7) *The Abortive or Non-paralytic Form.*—As has been already mentioned, Wickman drew attention, in 1904, to the very important type of cases in which poliomyelitis runs its course without causing any paralysis; and the experience of recent epidemics has shown that such cases are quite common. Draper estimates the proportion of their occurrence as 50 per cent. of the whole number, and others have placed it even higher. In this type, the children present exactly the same general symptoms as we are familiar with during the early stages of the ordinary paralytic cases, but without any paralysis following. The character of these general symptoms varies in the non-paralytic, as in the paralytic, cases. In one group they are mainly gastro-intestinal, in another connected with the throat, while in a third the patient may only show general malaise with no local manifestations. When such cases occur sporadically, they are usually diagnosed as influenza. It is, of course, obvious that they may possibly constitute a serious cause of the spread of the disease.

Seeing that the central lesion in *herpes zoster* is so similar to that in acute poliomyelitis, it might be expected that the two diseases would often occur together; but this has only rarely been described. During the Edinburgh epidemic, already referred to, there were no more than the usual number of cases of herpes zoster brought to the Children's Hospital.

Diagnosis.—The presence of poliomyelitis cannot be recognised with certainty until the paralysis develops. When a local loss of power sets in acutely, however, with flaccidity of the muscles and the other clinical characters already described, the diagnosis is generally easy, and the early onset of muscular wasting soon supplies its confirmation.

There may be some difficulty in the early stages in distinguishing the meningitic and cerebral types of the disease from cerebro-spinal meningitis. This difficulty can usually be removed by an early examination of the cerebro-spinal fluid; and the fact, that cerebro-spinal meningitis prevails mostly in the spring, and poliomyelitis in the late summer and

autumn months, is also helpful. After a few days, if any local paralysis has appeared and is at all extensive, the diagnosis becomes simple. When the muscular involvement is very limited in extent, however, it may be difficult, or impossible, to make sure of it in the early stages of the case.

Occasionally, cases of rachitic, syphilitic, and scorbutic pseudo-paralysis, and of acute infective epiphysitis and rheumatism, have been mistaken for the results of poliomyelitis. I have also known both diphtheritic paralysis of the lower limbs, and paresis of an arm occurring during the onset of chorea to be mistaken for this disease. In these cases the paralysis always begins gradually.

Old-standing cases of poliomyelitic paralysis affecting small muscular areas in the lower limbs sometimes show defective movements which are apt to be attributed to congenital malformations or to hip-joint disease. The diagnosis between spinal and cerebral paralysis in childhood has been dealt with in the last chapter (p. 612).

Prognosis.—In the acute stages of the disease, the prognosis as to life is good, except in those cases in which the respiratory muscles are involved. Death never occurs from toxæmia. When a child recovers from an acute attack with his muscles of respiration much affected, the risk of death from any chance catarrh spreading to the bronchi and lungs, at a later period, is very serious.

During the attack, the prognosis as to its probable effect on the child's future cannot be given with any certainty, until sufficient time has elapsed to make sure that there is not going to be a further extension of the lesion. In nearly all the cases, if no additional weakness occurs within six to twelve hours of the first paralysis, there is little chance of any further involvement; but a later spread is just possible, up to the seventh or eighth day.

According to Draper's experience, profoundly stuporous cases generally recover; and he believes that "increased alertness and apprehension on the part of the child with an existing paralysis is of graver significance." He has also found that, as a general rule, the smaller the number of cells present in the cerebro-spinal fluid during the first twelve or eighteen hours from the onset of the illness, the less chance is there of paralysis occurring. In the fatal cases the number of cells

is almost invariably very large—over 700 in the c.mm. After the first twenty-four to thirty-six hours, the examination of the cerebro-spinal fluid has no prognostic value.

In the common sporadic cases of the disease in which there is well-marked paralysis of one limb, the chance of complete recovery is very small. I have only seen one or two instances. In the milder and more irregular types met with during an epidemic, however, and especially in those in which several limbs or other parts are partially affected, the chances of recovery are much greater; and complete, or almost complete, recovery of power is not at all uncommon.

In cases in which the paralysis passes off entirely, it usually does so within a month or two of the onset of the attack. The younger the children, the more likely are they to recover.

The proportion of recoveries has varied considerably in different epidemics. Wickman reported that in 530 cases which were re-examined from twelve to eighteen months after the attack, 56 per cent. showed paralysis, and 44 per cent. had recovered. In most epidemics, however, the proportion of complete recoveries is not nearly so large as this; in several, it has been estimated as about 16 or 17 per cent. In severe cases in which several limbs are involved, some of the parts affected may generally be expected to recover entirely.

In any case, most of the progress takes place within the first six months; but, under careful treatment, improvement may continue for as long as two years. If, after twelve months' treatment, the power shows no sign of returning, little improvement can be hoped for. If, however, an old-standing case which has not received proper treatment at first comes under energetic management, even several years later, very considerable benefit is sometimes observed. The prognosis as to the degree of recovery possible depends, of course, very largely on the extent to which skilled treatment is carried out.

Treatment.—*Isolation.*—It is very rare that direct infection from the patient occurs in this disease; but it is certainly possible. The other children should not therefore be allowed to go near him during the first three weeks, or even longer if there is any nasal catarrh. During an epidemic, other members of the household who may be carriers should be

isolated to a reasonable extent for ten days. They should also be recommended to cleanse the nose and mouth frequently with a saline or alkaline lotion. This does just as well as an antiseptic solution, for it has been shown that the normal nasal secretions have a strong power of neutralising the poliomyelitis virus. Possible carriers must be very careful always to wash their hands when they have been contaminated by secretions of the mouth or nose (as in coughing and sneezing), and after defæcation. Needless to say, kissing must be forbidden.

In the *acute stage*, that is to say from the onset of the illness till all pain and tenderness have subsided, the first indication is complete rest, general and local, and the patient must be kept in bed even though the symptoms are very slight.

From the first appearance of paralysis, the posture of the affected limb must be arranged so that the affected muscles are kept in a state of relaxation and not damaged through overstretching by the opposing muscles, or by the force of gravity. When the flexors of the elbows are paralysed, for example, the arm must be kept in a sling; and when the foot drops, owing to paralysis of the tibial group, the ankle must be held at a right angle by a splint or by plaster.

While the tenderness and pain on movement last, the affected part should be kept from all unnecessary movement. For this purpose, in the case of the lower extremity, a padded plaster of Paris case is very useful; and the bed clothes should be kept by a wire cradle from pressing on the toes. It is soothing to the patient and good for the nutrition of the limb to have it kept thoroughly warm. This may be done by padded stockings and hot bottles, or by having an ordinary electric light bulb attached to the wire cradle (Fig. 249). When the pain is severe, hot baths are sometimes found to relieve it. Morphine and aspirin are also useful, and Ruhräh and Mayer recommend antipyrine (1 gr.) with codeine ($\frac{1}{30}$ gr.) every two hours, for a child of twelve months—to be increased or diminished according to its effect. In some cases, relief of pain is obtained by lumbar puncture. If there are symptoms of respiratory distress or failure, oxygen inhalation should be tried.

Apart from the relief of pain, little benefit can be expected

from the administration of drugs. After the nervous tissues have been involved, formaldehyde is found to have no effect. Care must be taken in severe cases to prevent the formation of bed-sores. While the tenderness lasts, massage and electricity should not be employed, nor voluntary movement of the affected limb encouraged.

Serum Treatment.—The injection of immune serum into the spinal canal, and at the same time into the veins or subcutaneous tissue, is capable, according to Netter, of arresting the course of the paralysis when it has begun, and even of making it disappear. To do this, however, it has to be administered within the first four days. When given before the paralysis has begun, it may prevent its development.

In the *Convalescent Stage*, which lasts from the disappearance of the tenderness to the end of the period of spontaneous improvement—that is to say, about two years—care must be taken to keep up the child's general health and the nutrition of the affected muscles, to regulate their exercise and rest, and to prevent causes of permanent deformity. The chief indications are :—

(1) To get the child up and out as soon as the pain and tenderness on movement have passed off, unless the trunk muscles are extensively and severely affected.

(2) Systematic gentle massage should be started at once. At first, it should be given for ten or fifteen minutes only, for, if continued too long, it exhausts the muscle just as over-exertion does. Great care must also be taken not to strain the weak muscles. Massage is a very valuable part of the treatment; it should be carried out regularly, twice a day at first, and in the later stages, intermittently, for several weeks at a time, and continued for at least two years. It is, of course, a great advantage if the services of a trained masseuse can be obtained; but, in most cases, this can only be arranged for part of the time; and the mother or nurse, if intelligent, can usually be taught to do it fairly well for the rest. The "Directions to Mothers regarding Children with Paralysed Limbs," in use at the Great Ormond Street Children's Hospital which will be found in Appendix D, give plain instructions which are easily carried out by the mothers under supervision.

(3) Electricity was formerly regarded as of great importance, but experience has shown it to be rarely of much value.

Faradism is certainly of no use to affected muscles which do not react to it; and it may do them positive harm by stimulating their opponents. Weak galvanism, if skilfully applied, may occasionally do good by causing contraction in weakened muscles which the child is unable to move voluntarily, and also probably by improving their nutrition. In such cases, which however are rarely met with, its continued use is indicated; but there is the great disadvantage that it generally frightens and distresses the child. In the most successful cases I have seen, it was not used at all.

(4) The affected limb must still be kept constantly warm by padded stockings and hot bottles; and its circulation should be encouraged by the use of alternate hot and cold douches.

(5) Another important indication is the encouragement of voluntary movements which involve the affected muscles. This must be managed so as not to cause exhaustion from undue strain. Even when the child cannot move the limb at all, he may be able to produce some visible contraction of its muscles. His attention should be drawn to these, and he should be urged to practise them frequently. Sometimes when the feeble contractions are not usually sufficient to move the limb, they can do so, to a slight extent, when the child is lying in a warm bath. If this is so, it is a great source of encouragement to him and to his mother. Repeated persistent attempts to move a paralysed limb are certainly often beneficial, even when for long they have no visible effect; and, when persevered in, they may in time be rewarded by the appearance of slight but increasing movements; and these may ultimately lead to unexpected improvement.

(6) Lastly, splints, plaster, and slings, used in the acute stage to avoid overstretching of the paralysed muscles, must be continued;[1] and contractures of the damaged muscles must also be treated, when they appear, by similar measures. The best form of support to use is the celluloid splint, which was first introduced by Calot in the treatment of tuberculous joints. The method of preparing such splints is described by Dr Batten in his Lumleian Lectures.[2]

Later Treatment.—This is not the place to deal with the surgical and orthopædic treatment of the deformities due to

[1] See paper by Sir Robert Jones, *Brit. Med. Journ.*, May 1914, i., 1165.
[2] *Brain*, 1916, xxxix., 115.

poliomyelitis. It may be well, however, to refer to the great practical value of the advances made in this subject during recent years. The measures employed consist in rectifying such deformities as contractures of the hip, knee, and other joints, the use of mechanical supports of various kinds, transplantation of tendons, the fixation of flail joints, nerve-crossing, and various other devices which make up an important and difficult part of the work of the modern orthopædic surgeon.[1]

Immunisation.—It has been shown that intraspinal injection of serum derived from monkeys or human beings, who have recently (within five years) recovered from an attack of poliomyelitis, will prevent the development of paralysis in monkeys after an intracerebral injection of the virus; and it may be advisable that injections of immune serum of this kind should be given, in the case of children during an epidemic, both into the spinal canal and into the veins or subcutaneous tissues, as a prophylactic measure.

From the results of experiments on animals, it seems possible that the administration of formaldehyde by mouth (1 to 5 grs. four or five times a day, for a fortnight after exposure to infection) may have some effect in diminishing the chance of taking the disease.

Encephalitis Lethargica (*Epidemic Stupor*).

During the winter of 1916-17, there occurred in Vienna a considerable number of cases of an epidemic cerebral disease, the symptoms and pathological lesions of which showed it to be a clinical entity of an unfamiliar type.[2] In the early spring of 1918, similar cases began to appear in England;[3] and about the same time a more severe outbreak of the same disease was observed in France.[4] Cases were also reported from America in the autumn of 1918; and, since then, the disease has become increasingly prevalent in this and other countries, and much work has been done on the subject. The disease is now known

[1] R. W. Lovett, *The Treatment of Infantile Paralysis*, London (Heinemann), 1916.

[2] Economo, *Wiener klin. Wochenschr.*, 10th May 1917, 581.

[3] S. A. Kinnier Wilson, *Lancet*, 1918, ii., 7.

[4] A. Netter, *Soc. Méd. des Hôpitaux de Paris*, 22nd March, 12th, 19th, 26th April, and 3rd May 1918; *Bull. de l'Acad. de Méd.*, 7th May 1918, lxxix., 337; and *ibid.*, 1920, lxxxiii., 303.

as encephalitis lethargica or epidemic stupor, and it has been shown that it is not a new condition, but one which has frequently occurred in former times in various parts of the Continent. Although, in most epidemics hitherto reported, the large majority of the cases have occurred in adults or adolescents, in some of them there have been many cases met with in children and even in young infants.[1] The disease is most prevalent in winter and spring.

Etiology and Pathology.—The bacteriology of encephalitis lethargica is as yet undetermined. The virus, which is said to be filtrable, has been found in the mouth and naso-pharynx, as well as in the tissues of the nervous system; and it probably passes from the throat to the mid-brain and medulla through the lymphatics.

The pathological lesion consists in an acute diffuse encephalomeningitis with cellular infiltration of the veins, venules, and capillaries.

Symptoms.—In typical instances, the main symptoms of the disease are three in number—stupor, general asthenia, and paresis of the ocular and sometimes of other cranial nerves. There is a striking absence of fits, and in many of the cases there is neither paralysis of the extremities nor any other definite physical signs of organic disease of the nervous or other systems of the body.

Generally, the onset of the stupor and other manifestations is relatively acute and violent, and repeated vomiting may be the earliest symptom to appear; sometimes headache and giddiness are complained of. Occasionally the stupor is preceded for some days by listlessness and drowsiness, or there may be great restlessness and noisy delirium. When the typical lethargy has set in, the child lies on his back with the eyes closed, the legs stretched out, and the arms alternately flexed and extended. The muscles show some degree of rigidity, but the limbs can be moved passively, and tend to remain in any posture in which they are placed (*flexibilitas cerea*). Sometimes they show rhythmic tremors. The sensibility and all the reflexes may be normal, or the tendon jerks may be abolished. There is no muscular wasting. The face is strikingly expressionless and mask-like. There is often

[1] F. E. Batten and G. F. Still, *Lancet*, 1918, i.; 636; and Josephine B. Neal, *Arch. of Pediatrics*, June 1920, xxxvii., 321.

incontinence of urine and fæces. During the first few days, there may be a moderate degree of pyrexia, but later the temperature remains normal. The pulse may be rapid, or slow and somewhat irregular. The respiration is unaffected.

Although the child is apparently unconscious, he can without difficulty be roused by speaking to him, and will put out the tongue, open the eyes, and even follow the finger or a light when told to do so. The movements, however, are sluggish and, though he evidently sees things, he shows no sign of recognising them. When the drooping eyelids are raised, the eyes are found to be divergent, and they may show nystagmoid movements. Diplopia is often present. The pupils may be contracted, or dilated and fixed, or normal. There is no optic neuritis. Although the ocular muscles are those most frequently affected, there may also be a degree of paresis of the tongue, palate, larynx, or pharynx. Occasionally cervical rigidity is noticed. The appetite is generally not much diminished; and the child will sometimes sit up and take his food, although the stupor returns rapidly after he has taken it. Usually he swallows well, but sometimes a tube has to be used. At times when set on his feet, the patient can walk a few steps when told to do so, but he takes no notice of his surroundings. His answer to questions may be accurate, but they are long in coming. The cerebro-spinal fluid may be quite normal, or there may be slight or even marked lymphocytosis of short duration, with a moderate increase of albumin.

Economo has pointed out[1] that this disease has shown a curious tendency to change the character of its symptoms in different epidemics; and, while the above description gives a fair account of the symptoms usually observed in the cases first seen in this country, the clinical picture in recent outbreaks has often varied a good deal in its details. These variations have resulted in various clinical types having been described by different authorities. The classification given by A. S. MacNalty[2] is as follows:—

(1) A type displaying general disturbances of the functions of the central nervous system, but without localising signs.

[1] *Wiener klin. Wochenschr.*, 1920, xxxiii., 329 and 361.

[2] *Proc. Roy. Soc. Med.*, Nov. 1918, xii., No. 1 (Section of Medicine), p. xvii.; and, with Dr S. P. James in *Rep. to Loc. Govt. Board on Public Health and Medical Subjects*, N. S., No. 121, 1918, 14.

(2) Types with nervous localising signs:—

(*a*) Clinical affection of the third pair of cranial nerves.

(*b*) Affections of the brain-stem and bulb. Local lesions of other cranial nerves.

(*c*) Affections of the long tracts, *e.g.*, pyramidal (as shown by the presence of Babinski's sign), pre-pyramidal (von Monakow), as evidenced by tremors, etc., and up-coming afferent tracts.

(*d*) Ataxic types (involvement of the cerebellar mechanism).

(*e*) Affections of the cerebral cortex.

(*f*) Types indicating some evidence of spinal cord involvement.

(*g*) Types indicating possibly an affection of peripheral nerves (polyneuritic cases).

(3) Mild or abortive types of the disease, with or without localising signs in the central nervous system.

The duration of the disease varies greatly. It may be fatal in a few days, but generally lasts for weeks or months. In the cases which recover, the stupor continues for three to five weeks and then gradually lessens; but it may be many months before the child returns to his normal condition.

The occurrence of more than one case in a family is not common, but I have seen, in the practice of my friend Dr Goossens of Bruges, a brother and two sisters suffering at the same time from different types of it. The boy, of seven, was a severe and typical case with fever, marked lethargy, and ocular paralyses. The elder girl, of about five, had what seemed to be the neuritic form of the disease; and in the younger one, the symptoms were very slight and passed off in a few days.

Prognosis.—According to Netter,[1] about two-thirds of the cases, of all ages, recover. When death occurs, it may be due either to the disease spreading to the medulla, to pneumonia following the involvement of the pneumogastric or glosso-pharyngeal nerves, or, in long-continued cases, to marasmus. No indication of intellectual defect or other permanent damage to the brain has been reported.

Diagnosis.—In the early days of the illness, it must often be impossible to do more than suspect its nature and to

[1] *Bull. de l'Acad. de Méd. de Paris*, 1920, lxxxiii., 303.

differentiate it from tuberculous meningitis, and from such a condition as toxic enteritis with secondary cerebral thrombosis.

The absence of convulsions which are common in both these conditions, and of the severe diarrhœa which is characteristic of the latter, are helpful in the diagnosis. The presence of marked head-retraction is also against the presence of encephalitis lethargica; and the fact that the cerebro-spinal fluid is usually normal in this disease may also be helpful. The frequency with which the eye-muscles are affected, and the slight and temporary elevation of the temperature, are also important points in the diagnosis. There should not be much difficulty in distinguishing the symptoms from those of acute poliomyelitis. It is probable that in children, as in adults, many mild atypical cases occur.

No form of **treatment** of proved value has as yet been discovered.

CHAPTER XXXI

ON MENINGITIS AND HYDROCEPHALUS

Tuberculous Meningitis.

TUBERCULOUS meningitis is a very common disease of childhood, especially among the lower classes. It is most frequently met with during the second and third years. It may occur, however, as early as the third month or even sooner; and it is not uncommon at any later period of childhood.

In many cases there is no family history of tuberculous disease and no clear indication of where the infection has come from. The milk supply, however, is often under suspicion, and, not uncommonly, we find that a phthisical relative has lived in the same rooms or been much with the child.

The meningeal affection is probably always secondary to caseating tuberculosis elsewhere. This may be in the bronchial or mesenteric glands, in the bones or joints, the lungs, the brain, or the ear. But, during life, there is frequently no indication as to where the original focus lies. In some cases there is an account of a head injury. In a large proportion of the cases there is a history of the child's resisting power having been recently lowered by an attack of measles or whooping-cough.

Symptoms.—Children who have been debilitated by gross tuberculous lesions, are liable to be suddenly attacked by severe symptoms of tuberculous meningitis. The patient, who has been in his usual languid state of health, suddenly develops paralysis of one or more limbs or of the face or ocular muscles, and soon after has a convulsion or becomes very drowsy. Such cases generally have a rapidly fatal course.

In the great majority of cases, however, the initial lesion is one which has not hitherto materially affected the child's general health. When this is so, the onset of the brain symptoms is generally very insidious.

In a typical case, the onset of characteristic symptoms is preceded by a *premonitory stage*, which may last for two or three weeks, or even for two or three months. During this period the child is vaguely out of sorts. He is languid and irritable during the day, and restless and wakeful at nights. He loses appetite and weight, and sometimes vomits with no apparent cause. He is constipated, has occasional rises of temperature, is drowsy at times, and sometimes flushes and complains of headache. Occasionally incontinence of urine or fæces may begin. The pulse may be slow and irregular. If he is old enough to be speaking, he will probably stop doing so. In many ways his mother finds him changed and unlike himself in disposition.

At this period, while it is obvious that the child is far from well, there are usually no symptoms present which might not be attributed to dyspeptic derangement in a teething baby. In older children and adolescents, the early symptoms of tuberculous meningitis may closely resemble those of hysteria.

Sooner or later the disease shows itself more distinctly by the marked aggravation of some of the already existing equivocal symptoms and the occurrence of others of a more definitely cerebral character. The *period of invasion* may now be held to have begun. It is customary to divide this period into three not very well-defined stages. The first is one of *irritation*, and corresponds to the implication of the meninges and cortex. The second is that of *pressure*, during the accumulation of fluid in the ventricles. The last is characterised by *relaxation* and paralysis, and indicates the involvement of the medulla.

Tuberculous meningitis is such a treacherous disease that we can hardly speak of any group of its symptoms as pathognomonic. The most characteristic combination, however, is that of *vomiting*, *headache*, and *drowsiness* with *constipation*. This should always arouse suspicion, and the onset of *convulsions* in addition may be held as confirmatory.

Early in this stage the peculiar *facies* which has been already described (p. 9, Figs. 4, 6, and 7) generally develops; the cheeks are flushed, and the tache cérébrale is usually present. The patient tends to lie constantly on his side with the limbs fully flexed. He is very irritable, and resents being

disturbed. If the bed clothes are pulled off, he clutches at them and draws them back and screams irritably (*Stocker's sign*). He may show marked *photophobia*, but this is not so common a symptom in children as in older patients. Occasionally the child may utter a sudden sharp scream, the so-called *hydrocephalic cry*. Far too much prominence has been given to this symptom, which is not an important one and occurs only in a small minority of the cases. A piercing scream is much more characteristic of acute ear disease than of meningitis.

The *headache* is sometimes very severe, and a bad headache in a young child is always an ominous symptom, as it is

FIG. 171.—Tuberculous Meningitis. Retracted abdomen.

rarely in them due to functional disease. Occasionally, severe pain is complained of in some other part of the body. If the *drowsiness* is marked, it also is very significant, provided the action of alcohol and other narcotics can be excluded. *Vomiting* is nearly always present at some period in the case. It may last long, but sometimes it only occurs two or three times at the beginning. *Constipation* is also a pretty constant symptom; rarely there is diarrhœa. Unless abdominal tuberculosis is present, there is usually, though not always, marked *retraction of the abdomen* (Fig. 171).

At first the *pulse* may be regular and simply accelerated, but soon it develops the peculiar characters already described (p. 467). The *respiration* early becomes irregular, and frequent deep sighing is very characteristic. The fontanelle is tense

and pulsating; the neck stiff at times and occasionally distinctly retracted. *Head retraction*, however, is rarely very marked in this form of meningitis, nor is it often continued for any length of time.

Convulsions in an early stage are less characteristic of this than of some other forms of meningitis, but they are not uncommon, and they may occur at any period of the disease. They may be followed by paralysis of limbs and by rigidity. The pupils are usually contracted and sometimes oscillate, and there are often irregular nystagmoid movements of the eyeballs. Various degrees of *squinting* are common, and ptosis is also often met with. The *temperature* is irregular, though rarely very high. Occasionally it remains normal or subnormal throughout. The blood often shows a considerable *leucocytosis*—much greater than in other forms of tuberculous disease. On *lumbar puncture*, the fluid generally spurts out. It is clear and colourless, in most cases, when it is drawn off, though it often shows a slight deposit on standing. The leucocytes in this are found to be mostly lymphocytes. An excess of albumin (0·1 to 0·3 per cent.) is always present. Tubercle bacilli can almost always be demonstrated in the fluid, if the examination for them is sufficiently careful, but the finding of them takes more time than it is worth. When a test-tube full of the fluid is allowed to stand, a fine semi-transparent filiform clot forms in its centre. This should be dried on a slide, stained, and examined for the bacilli.

In the *second or pressure stage* of the illness, the drowsiness is the most marked feature. The vomiting usually ceases, the pulse gets more markedly irregular and slow, various local paralyses may occur, and quasi-purposive movements of the face, lips, jaws, and hands are common. Grinding of the teeth is frequently heard in older children. The urine and fæces often pass involuntarily. Cheyne-Stokes respiration develops, and local or general convulsions may occur.

Finally, the *stage of paralysis and coma* sets in. In it the child lies on his back, more or less entirely unconscious, with his limbs extended and his hands often crossing one another over the pubes. The pupils are widely dilated, the conjunctivæ insensitive and often covered with shreds of muco-pus. Generally a degree of optic neuritis is present, and sometimes choroidal tubercles are found; but these are more

characteristic of general tuberculosis. During this stage the bulging fontanelle often becomes flattened, the pulse is regular, very rapid, and weak, the respiration shallow and quick, and the temperature shows irregular rises. Swallowing becomes increasingly difficult. In the course of the last week, pyuria (from bacillus coli infection) is common; and glycosuria is also often met with, as Still and Garrod have pointed out.

The final stage may be painfully prolonged for many days. Sometimes there is apparent improvement for a day or two before the end.

The **duration** of the illness varies considerably in different cases. In cachectic children, as already mentioned, death may occur within a few days, and generally within a week. In ordinarily vigorous infants, the symptoms may be expected to last about three weeks before death takes place. Some cases go on much longer, however, when carefully nursed, and Barlow mentions one which lasted for sixty-three days.

Diagnosis.—Owing to the number of its symptoms and their indefinite character, tuberculous meningitis is very often mistaken for other conditions at different stages of its course. The presence of tubercle bacilli in the cerebro-spinal fluid, though important, cannot be regarded as an absolute proof of the presence of tuberculous meningitis. They may conceivably be present without meningitis, owing to rupture of a caseous nodule on the brain into the meningeal cavity.

Dyspeptic vomiting, especially in teething children, is one of the diseases which gives rise to difficulty. And its symptoms may be so like those of early tuberculous meningitis that the diagnosis is impossible in the early stages. In judging between the two conditions, we should estimate carefully the other symptoms of digestive disturbance and the state of the gums. We should also look out for retraction of the abdomen, slowness and irregularity of the pulse, and a sluggish condition of the pupils. The occurrence of convulsions would be in favour of meningitis, although it might also occur in the other disease. A dose of castor oil will sometimes clear up perplexing symptoms in a dyspeptic and teething child.

In the cases in which *cyclic vomiting* begins in young infants, it may simulate tuberculous meningitis to a considerable extent, as may some cases of *gastric influenza*,

and also the onset of various of the *exanthemata* in nervous children.

Cases of *typhoid fever* occasionally resemble tuberculous meningitis very closely. In considering the differential diagnosis, we must note the temperature, which is usually higher in typhoid, and the pulse, which is less slow and more regular. The typhoid patient tends to lie on his back, is not irritable, and does not show Stocker's sign. He also shows no cervical rigidity, the abdomen is more or less full instead of being retracted, and the spleen is usually enlarged. After the eighth day, spots may be found, and Widal's test will generally decide the matter.

Acute pneumonia, especially when it affects the apex, often gives rise to mistakes. The rapid onset with high fever, the pneumonic facies (p. 7), the regular pulse, and the early appearance of rapid respiration, should enable the diagnosis to be readily made by any one who remembers the occurrence of "cerebral pneumonia." A high degree of polymorphonuclear leucocytosis is in favour of pneumonia.

Acute middle-ear disease is another condition which simulates meningitis. It sometimes gives rise to irregular pyrexia, irritability, drowsiness, screaming, vomiting, some bulging of the fontanelle and stiffness of the neck, and to convulsions. The temperature is generally higher and more continuous than in tuberculous meningitis, the abdomen is not retracted, and there is deafness. An examination of the ears or the appearance of discharge from the meatus settles the question.

Uræmia in young children occasionally presents symptoms difficult to distinguish from those of tuberculous meningitis. The history of the onset (*e.g.*, if after scarlet fever) and the condition of the urine should suffice for the diagnosis.

Sub-acute liver atrophy also at times gives rise to symptoms which are very like those of tuberculous meningitis.

Cases of *spurious hydrocephalus* are to be distinguished by the history of recent severe diarrhœa and by the presence of a depressed fontanelle, frequently also by a distended abdomen.

Cases of *polioencephalitis* often closely resemble tuberculous meningitis in the early stages.

The diagnosis between tuberculous meningitis and *intracranial tumour* has been already referred to. We must bear

in mind the rarity of localising symptoms from the latter in children under two.

The distinction between tuberculous and other forms of meningitis will be dealt with later.

Treatment.—When tuberculous meningitis is really present, treatment is probably never of any use. It is almost always well, however, to order some treatment, partly for the parents' sake and partly because we can rarely be absolutely certain, at first, that our diagnosis is correct. There are probably few practitioners of many years' standing who cannot recall instances of children whom they believed, without doubt, to be dying of this disease and who made a complete recovery.

The favourite remedy to administer in these cases is mercury, and it may be prescribed internally, in the form of liq. hydrarg. perchlor. (1 drm.) or as calomel (which has the further advantage of counteracting the constipation), or it may be applied externally as mercurial ointment. Small doses of pot. iodid. may also be given, or iodoform ointment (10 per cent.) may be applied to the head.

When severe headache is present, lumbar puncture or the application of one or two leeches to the temple sometimes give relief; and chloral may be given if convulsions set in. Surgical treatment has been attempted from time to time, but it cannot be said ever to have been proved to be of value. Lumbar puncture certainly gives temporary relief in a few cases. In the great majority, however, it has no effect at all; and it has the disadvantage of sometimes prolonging the hopeless illness considerably.

Acute Suppurative Meningitis.

Acute purulent meningitis is not uncommon, especially in the first year of life. It is sometimes predisposed to by an injury, and may be due to infection by staphylococci, streptococci, or other pyogenic organisms spreading from neighbouring parts, as in the case of suppurating sores, disease of the petrous bone, erysipelas, etc. In the majority of cases, however, it is caused by the pneumococcus. When this is so, the meningitis may be secondary to pneumonia or empyema; but this is by no means always the case. The distribution of the lesion

varies in different cases, but generally the vertex is severely affected.

Symptoms.—The course of the disease is very acute in most cases. It is generally fatal within a few days or, at most, within a week. Occasionally, however, especially in older children, it may last much longer; and, if the disease is localised, it may possibly be recovered from. This, however, is exceedingly rare.

The onset is sudden, with high fever, vomiting, headache, delirium, and giddiness, and there are generally convulsions. The fontanelle bulges, there is usually head retraction with general rigidity and tenderness, and often strabismus and nystagmoid movements of the eyes. Coma supervenes early, and there is sometimes hyperpyrexia (107° to 108°) before death. There is usually a high degree of leucocytosis.

In cases where the vertex is the part chiefly affected, the symptoms are often very obscure; and without lumbar puncture the diagnosis may be impossible. In such cases it may be difficult to make sure of any head retraction, and the pyrexia, vomiting, and stupor might accompany any high fever. Purulent meningitis occurs, not very rarely, as a terminal complication in little weakly babies, and in them it may cause almost no symptoms.

The diseases most likely to be mistaken for this form of meningitis are acute otitis, meningococcal meningitis, and cerebral abscess.

Treatment.—Should any primary source of suppuration be discoverable, it should, of course, be dealt with at once. In strong children when the distress is great, the application of one or two leeches behind the ears may give considerable relief in the early stages. Generally, we apply an ice-bag to the head and give urotropine in doses of 5 to 10 grs. every four hours; also bromide and chloral or inhalations of chloroform when convulsions threaten. Prolonged hot baths (95° to 100° F.) are also useful. Mercurial inunction seems sometimes beneficial. Lumbar puncture may lessen the pain obviously, and, if so, should be repeated. In cases which survive the first week or so, the treatment is the same as that for posterior basic meningitis.

Posterior Basic Meningitis.

(*Sporadic Meningococcal Meningitis.*)

This is the name usually given to a form of non-tuberculous lepto-meningitis which begins at the posterior part of the base of the brain and is due to a variety of meningococcus. This organism was first described by Dr G. F. Still.[1] It is now regarded as a form of the diplococcus intra-cellularis meningitidis of Weichselbaum which is responsible for epidemic cerebro-spinal meningitis. The mode of infection is still obscure.

The large majority of cases occur in children under a year old. The disease is comparatively rare after the third year. The cases occur sporadically, and here, as well as in London, more are met with during the first four than during the other eight months of the year.

The disease usually affects strong, healthy children—not rarely breast-fed babies. In a considerable proportion of cases, however, there is a history of antecedent catarrh of the nose, bronchi, or intestines.

Symptoms.—The three cardinal symptoms of the early stage are *head retraction*, *vomiting*, and *convulsions*. Any of the three may come first, and the other two generally follow within a day or two. The child seems anxious and ill at ease, and his fontanelle bulges. Sometimes he has a prolonged attack of screaming. The head retraction is usually very marked, and it is the most characteristic symptom. It may vary in degree, but when once it sets in, it usually lasts till death, or at least till shortly before. In cases which recover, the head retraction persists for many weeks. *Tonic spasm* of the whole body generally occurs sooner or later. In its most severe and characteristic form it gives rise to extreme opisthotonos (Fig. 172). The upper extremities are often strongly adducted, with the elbows fully extended, the wrists and fingers flexed, and the forearms extremely pronated. The lower limbs are also adducted and fully extended at the hips, knees, and ankles; the toes are usually flexed on the sole, but may be dorsiflexed. At an earlier stage all the limbs may be in a state of flexion. Kernig's symptom is generally well marked.

The vomiting is usually most severe at first, but it may

[1] *Journ. of Path. and Bacteriol.*, May 1898, v., 147.

recur from time to time during the illness. The convulsions also occur mainly at the beginning. Constipation is not often a prominent symptom, and frequently there is some diarrhœa. The eyes may have a peculiar staring look owing to commencing hydrocephalus; but, in the early stages at least, there is none of the cerebral facies which is so characteristic of tuberculous meningitis (p. 9), and there may be, also, a complete absence of drowsiness. When the disease occurs in an older child, he often feels giddy and says he is "going to tumble." Nystagmus and strabismus are not uncommon. Although

FIG. 172.—Posterior Basic Meningitis. Extreme Opisthotonos.

optic neuritis is rare in this form of meningitis, temporary amaurosis with normal optic discs often occurs and sometimes lasts for months in cases which ultimately recover completely. Deafness is also sometimes met with.

The pulse is generally rapid and quite regular. The temperature varies; it is usually irregular, and often fairly high at first, and it may remain so for some weeks. It may not, however, be much raised. There is usually a marked degree of leucocytosis, 18,000 to 20,000. No abdominal retraction is present, or very little; and local paralyses are rare. Occasionally there is a slight joint affection or a swelling of one of the tendon sheaths; and generally passive movements of the limbs

are painful. An extreme degree of emaciation is very characteristic of the later stages.

A common sequel to the disease is hydrocephalus. Sometimes its clinical manifestations are few and indefinite. Usually it shows itself by bulging of the anterior fontanelle and slow growth of the head in size and weight. The sutures may separate and the lateral and posterior fontanelles gradually reappear. Sometimes craniotabes develops. Generally the

FIG. 173.—Posterior Basic Meningitis. Showing downward direction of eyeballs.

axis of the eyes changes so that the sclerotic is abnormally visible above the iris (Fig. 173). Cases are not uncommon in which all the symptoms are so slight that their real nature is not recognised until signs of hydrocephalus develop.

Duration.—Those cases which end fatally usually last about six or seven weeks. Sometimes the duration is only three weeks, and in other cases it is three months or more. When recovery takes place, the improvement is generally very slow.

Prognosis.—Posterior basic meningitis is the least fatal form of the disease. About one-third of the cases (sixteen out of forty-one of my cases) recover from the actual illness. This does not, however, accurately represent the amount of harm

done, for many of the recoveries are incomplete and only temporary. The blindness, above referred to, generally passes off completely in time. The deafness which occurs in a few cases is, however, generally permanent. The most serious lesion that may be left is chronic hydrocephalus. This not very rarely gives rise to sudden death, some months or even years after the patient has been supposed to have recovered. The disease also leads to mental defect in a considerable proportion of the cases.

Diagnosis.—The early onset of definite and continuous head retraction is the most distinctive symptom in these cases, and whenever present should suggest the probability of the case being one of this disease. In cases of suppurative meningitis the symptoms are generally more severe and the course much shorter. The chief points of difference between this disease and tuberculous meningitis may be summed up as follows :—

	Tuberculous.	Posterior Basic.
Age	Commonest during second year or later	Commonest during first year; rare after second
Onset	Insidious, after premonitory wasting and irritability	Sudden, during health, often with symptoms of catarrh
Facies	Cerebral facies appears early	Late in developing
Irritability	Great	Not so marked
Head retraction	If present, slight and intermittent	Severe, continuous, and early
Nystagmus	Rare	Common
Optic Neuritis	Common	Rare
Local paralyses	Common	Very rare
Persistent tonic spasm	Rarely marked	Generally extreme
Slow, irregular pulse	Generally present	Very rare
Constipation	Obstinate	Often absent, often diarrhœa
Abdominal retraction	Usually great	Never noticeable
Average duration	About three weeks	About six or seven weeks
Fluid from lumbar puncture	Clear; lymphocytosis; occasionally tubercle bacilli	More or less turbid; polynuclear leucocytosis, usually diplococci in the early stages

Treatment.—The most important part of the treatment in most cases consists in close attention to the child's digestion

and general nutrition, as debility, dyspepsia, and diarrhœa are often the main causes of death. When head retraction and rigidity are present the feeding should be very carefully managed, because otherwise there is considerable risk of inhalation pneumonia being set up.

Certain drugs have sometimes seemed useful and may be given, especially in the early stages, when this can be done without upsetting the digestion. The most important are pot. iodid. (1 or 2 grs. every two or four hours) and hydrarg. c. cret. (1 gr. twice or thrice daily). The external application of iodoform ointment (10 per cent.) or of mercurial ointment to the scalp seems sometimes beneficial. Occasionally, especially in the earlier stages, lumbar puncture is followed by decided relief of pain and improvement of the other symptoms, and if so, it should be repeated frequently. In the later stages it may also be tried, but generally it has no effect.

Epidemic Cerebro-Spinal Meningitis.

Acute meningococcal meningitis has, till recent years, been rarely seen in this country as an epidemic. About fourteen years ago, however, quite a large number of small outbreaks were reported from various towns such as Belfast, Glasgow, and Edinburgh,[1] as well as from country districts. Although it appears in epidemics, there seems to be very little risk of direct infection, not more than in ordinary pneumonia, for it is comparatively rare to find more than one case in a family. The disease may be spread by third persons who carry the virus in their nasal or faucial secretions. The period of incubation is unknown, but it is probably short. The majority of the patients are children; but older children are quite as often attacked as babies.

Although none of the clinical features can be said to be essentially different from those of posterior basic meningitis, they are generally so much more acute and intense in degree in the epidemic type that the clinical picture is very different. Even in the worst epidemics, however, there are many relatively mild subacute cases, and these are indistinguishable from the

[1] J. S. Fowler, *Review of Neurology and Psychiatry*, April 1907, v., 249; John Thomson and Stuart M'Donald, *Scot. Med. and Surg. Journ.*, March 1907, xx., 205.

posterior basic type. In temperate climates, the epidemics of this disease always occur in the spring months.

Symptoms.—The patient has usually, hitherto, been a strong, healthy child, and the onset is almost always very sudden. There is high fever, severe headache, and pains in the nape of the neck, the back, sides, and elsewhere. Vomiting almost always occurs, often there is delirium, and frequently convulsions. The child looks and evidently feels very ill in most cases. Quite often, difficulty of breathing is complained of, and there is an increased rate of respiration. Severe abdominal pain is not uncommon.

Probably the most important and distinctive physical sign

FIG. 174.—Epidemic Cerebro-Spinal Meningitis. (Dr J. S. Fowler's case.)

is cervical rigidity. It is only absent when the patient is comatose, but at first it may not be severe in degree. It is generally accompanied by acute pain on the slightest attempt to bend the head forward. More or less marked head retraction soon sets in (Fig. 174), and in the later stages the whole body is stiff and the most extreme opisthotonos is common (Fig. 175).

Kernig's symptom is nearly always present; the knee-jerks may be normal or absent. In the early stages the abdominal reflexes are usually quite abolished (Fowler); but they return as the acute symptoms subside. Generally the patients are hyperæsthetic and very irritable if disturbed. So long as they are left alone, however, they are usually apathetic and show no signs of suffering. In the less acute cases the child's consciousness is often strangely little affected. In some cases there is rhinitis, and in a few purulent iritis.

Various rashes are met with. Herpes on the lips and elsewhere like that in pneumonia is fairly often present; and occasionally a mottled erythematous rash appears on the trunk and limbs. The most characteristic skin lesion, however, is the purpuric eruption from which the popular term "spotted fever" is derived. This rash was seen in about a quarter of the cases in the recent Edinburgh epidemic. Its presence is of bad omen and usually indicates a severe type of the disease. The temperature curve is very irregular.

In a few cases enlargements of the larger joints and swellings in the subcutaneous tissues of the limbs are seen. Examination of the blood shows marked leucocytosis (10,000

FIG. 175.—Epidemic Cerebro-Spinal Meningitis. (Dr J. S. Fowler's case.)

to 45,000). Deafness is common and is usually permanent. Amaurosis, usually temporary, is often found at some stage of the case.

Diagnosis.—Lumbar puncture is of the greatest importance in diagnosis and should always be performed in doubtful cases, as it is sometimes only by its means that we can distinguish between this disease and some other forms of meningitis. In the very acute cases the cerebro-spinal fluid is turbid. In those less acute, it sometimes has the appearance of pure pus, and sometimes is watery and nearly quite clear. The meningococci are generally easily found, being in large numbers, both in the cells and in the surrounding fluid.

In the most acute, or "fulminant" cases, which are generally fatal in a few hours or days, the diagnosis may be very difficult

until lumbar puncture is done, because the severe general toxic symptoms more or less completely mask the special features of meningeal disease.

In some cases of epidemic cerebro-spinal meningitis, the disease sets in with severe diarrhœa and vomiting; and it is important to remember that several instances have been observed in which one child in a family has died of exceedingly acute gastro-enteritis with a purpuric rash but with no meningitis, while another has, soon after, taken a typical attack of acute meningococcal meningitis.

There is seldom any difficulty in distinguishing tuberculous meningitis from this disease. The form of meningitis which most closely resembles the epidemic cerebro-spinal variety in its symptoms is that produced by the influenza bacillus. In cases of this disease, the cerebro-spinal fluid contains numerous polymorphonuclear leucocytes and a quantity of Gram-negative bacilli. There is no improvement on treatment with Flexner's serum, and the prognosis is very grave.

Prognosis.—Before the use of the serum treatment, the mortality was always very high — sometimes 50 per cent., much oftener 70 to 80 per cent. or more. The younger the child, the smaller is the chance of recovery.

It must also be remembered that, while the recovery when it takes place may be complete, in a considerable proportion of the cases this is not so. Sometimes the child is left with chronic hydrocephalus, and less commonly with a cerebral lesion which causes serious mental defect. In many cases, there is permanent deafness without any mental impairment.

Treatment.—This consists in soothing the patient and sustaining his strength; and especially in the injection, into the spinal canal, of anti-meningococcal serum.

(1) The child must be kept very warm in bed and frequent hot baths should be given. These are of value in relieving the headache and restlessness, and in saving the strength. If the pains are very severe, a small hypodermic of morphine may be required. In cases which become chronic, the formation of bed-sores must be guarded against. No special dieting is usually necessary, but if there is marked opisthotonos, tube-feeding may be required for a time, as in posterior basic meningitis, to ensure the child's getting enough food, and to obviate the risk of inhalation-pneumonia.

(2) The use of various forms of anti-meningococcal serum has proved of great value. In the Edinburgh epidemic, Dr Claude B. Ker made use of Flexner's serum with striking success; and he estimated that if the injections were made within the first three days the mortality was not likely to exceed 16 per cent.[1] In using the serum, lumbar puncture is done and an amount of cerebro-spinal fluid slightly greater than the serum to be used is withdrawn. The serum is then injected slowly with the usual precautions, and the foot of the bed is kept raised for some hours. The dose of serum in the case of children varies from 15 to 30 c.c.; and the injections are repeated daily for three or four days.

Dr Ker also recommends the serum prepared in the Pasteur Institute by Dopter. In chronic cases of the disease he has found autogenous vaccines occasionally of great benefit.

Good results have sometimes been obtained from intravenous injection of serum in the early stages.

Chronic Internal Hydrocephalus.

The cases of chronic hydrocephalus met with in practice are generally of the nature of internal hydrocephalus, that is to say, accumulation of fluid in the cerebral ventricles. External hydrocephalus is a very rare condition, which is secondary to defective development of the brain.

Causation.—The cause of chronic internal hydrocephalus varies in different cases. The great majority, however, are the result of meningitis in the neighbourhood of the 4th ventricle occurring either before or after birth; in the latter case, the exciting cause is usually the meningococcus, although frequently the original attack has been so slight that its meningeal nature has not been recognised. Cases due to congenital syphilis are not very rare and often yield rapidly to antisyphilitic treatment. Some cases are due to congenital defects which prevent the passage of fluid out of the ventricles, and others to the pressure of tumours at the base of the brain which have the same effect.

Mode of Production.—The ways in which distension of the ventricles comes about have hitherto been rather obscure,

[1] *Manual of Fevers*, by Claude B. Ker, London, 1911, 300.

but the recent work of Dandy and Blackfan on the physiology and pathology of the cerebro-spinal fluid[1] has thrown fresh light on the subject. In health, the formation and absorption of this fluid go on constantly and rapidly. Its formation takes place, practically only, in the ventricles, where it is derived by filtration and by secretion from the choroid plexuses; while its absorption occurs in the subarachnoid space, the whole of which is active in this way. It is taken up directly into the blood-capillaries, the lymphatics having scarcely anything to do with the process. There is practically no absorption of fluid from the ventricles. Therefore, in order that the normal balance of cerebro-spinal fluid may be maintained, it is essential that the path from the ventricles into the subarachnoid space—through the foramina of Monro, the aqueduct of Sylvius, and the foramina of Magendie and Luschka—should not be interfered with; for obstruction of the lumen of any of these will at once lead to overdistension of the ventricles. It is also, of course, necessary that the absorbent area of the subarachnoid space should be healthy, and that the fluid should not be cut off from any large part of it by adhesions.

Types of the Disease.—Cases of chronic internal hydrocephalus may be divided into two groups. The first of these consists of the "*obstructive*" cases—that is to say, those in which there is an obstruction to the passage of the fluid out of the ventricles, so that it cannot reach its place of absorption in the subarachnoid space. The second group is that of the "*communicating*" cases in which these passages are freely open. In them the accumulation in the ventricles is owing either to the absorbing power of the subarachnoid space having been diminished by disease or, more often, to the fluid being prevented from reaching the absorbing surface by adhesions about the base of the brain. The treatment of the two types of cases must obviously be different.

Dandy and Blackfan have found that the two types can be readily differentiated from each other during life by a simple proceeding which seems to be devoid of danger. This consists of the injection into the distended ventricles of a neutralised solution of phenolsulphonephthalein, and the

[1] *Amer. Journ. Dis. Child*, Dec. 1914, viii., 406; and *ibid.*, Dec. 1917, xiv., 424.

subsequent examination for it in the cerebro-spinal fluid removed by lumbar puncture. If the phenolsulphonephthalein appears freely in the cerebro-spinal fluid, this proves that the way out of the ventricles is open and that the hydrocephalus is due to something being wrong with the subarachnoid space and not to blocking of the cerebral passages. Ordinarily, there is no other way in which the obstructive and communicating cases can be clinically distinguished from one another; although, when a very large quantity of fluid is removed on lumbar puncture, it may be assumed that the passages are free, for the cavity of the spinal meninges, even when fully distended, cannot contain more than about 25 c.c. of fluid. The chronic internal hydrocephalus which follows meningitis may be of either type. In those communicating cases of hydrocephalus which are complicated by the presence of spina bifida and meningocele, the removal of the latter by operation is inadvisable, as it is almost always followed by an increase in the ventricular distension — probably owing to the consequent lessening of the absorbing surface.

Symptoms.—The most noticeable thing about a case of chronic hydrocephalus is usually the alteration in the shape and size of the head. This has been already described (p. 59, Figs. 26 to 31). As the head continues to enlarge, the sutures gape and sometimes, especially when the head is not enlarging rapidly, small rounded areas of craniotabes make their appearance in the parietal and occipital bones. When the enlargement is slow, also, there is often severe headache and vomiting, but in the ordinary rapidly growing cases these symptoms are usually absent. The increasing displacement of the roof of the orbit soon causes a downward direction of the eyeballs, so that the sclerotics over the iris become exposed and in time the pupils lie behind the lower lids.

In a few cases the sight is permanently lost from optic atrophy, but optic neuritis is rarely found. Often there is temporary blindness due to the heightened pressure, which passes off when the fluid ceases to increase. In many cases the sight seems unaffected. Occasionally other cranial nerves may be paralysed, and this sometimes gives rise to an erroneous diagnosis of cerebral tumour. The limbs often show a degree of ataxia, sometimes there is head retraction (Fig. 156), and not uncommonly severe spastic diplegia. In a considerable

number of the congenital cases of hydrocephalus, spina bifida is also present.

In cases which are advancing, the fluid varies in amount from time to time; and, when it is on the increase, there may be exacerbations of vomiting and screaming attacks. The screaming is distressing to the parents, but it is probably not due to pain. The cerebro-spinal fluid is generally clear and normal in appearance; but in some cases it is yellow and has the characters of an inflammatory exudate.

The child's body is often puny and always weak, and in many cases there is a tendency to convulsions.

Mental Condition.—Chronic hydrocephalus is a common cause of mental defect, and if the disease is at all severe in degree the intellect always suffers. In some slight cases the defect may be scarcely noticeable, and even in the more serious ones its degree is usually less than might have been expected from the appearance of the head. Hydrocephalic imbeciles are usually gentle and amiable in disposition, unless they have been spoiled, but they are not capable of much education. The prognosis as to mental improvement is generally better in cases that date from birth than in those which have begun in later childhood.

Diagnosis.—The only cases in which the diagnosis is apt to be overlooked are those in which the hydrocephalus is beginning to form rapidly when the head has not yet begun to enlarge and there have been as yet no definitely cerebral symptoms. In these cases the irritability, screaming, and vomiting are at first often attributed to digestive disturbance, until the displacement of the eyeballs and the appearance of craniotabes show their real nature.

Prognosis.—In most cases there is a slowly progressive increase of the symptoms; but instances are not very rare in which the fluid spontaneously ceases to gather after a time, and the child recovers partially with a permanently enlarged head, usually a damaged intellect, and some rigidity of the lower limbs. As has been already mentioned, most of the syphilitic cases improve or recover under early specific treatment.

Treatment.—In some instances withdrawal of an ounce or two of the fluid by lumbar puncture, or in the obstructive cases by tapping the ventricle through one of the lateral angles of

the anterior fontanelle, gives decided relief. Cases have occasionally been recorded in which tapping—usually on several occasions—has seemed to cure the disease; but this rarely happens. The severe screaming attacks, already mentioned, are always relieved for a time by tapping; and, in some instances, although reaccumulation of fluid takes place, the child remains easier and brighter for weeks after each puncture. The removal of a large amount of fluid at one time is inadvisable and may cause convulsions.

The internal administration of iodide of potash and mercury, and inunction with mercurial ointment, have been recommended for non-specific cases as well as for those due to congenital syphilis.

A large number of different operations have been recommended and performed for chronic internal hydrocephalus. The mortality of these has generally been high; but considering the very poor results of non-operative treatment and the deplorable outlook for the patient when nothing is done, it seems worth while to run even great risks if there is any chance of a permanent cure.

H. J. Stiles has operated on a number of cases by tying the carotid arteries—one a short time after the other.[1] The mortality of the operation is not great, and in some of the cases the previous progressive enlargement of the head certainly ceased after it. In others, however, the operation had no result.

It is unnecessary to describe the other operations by which it has been attempted to check the disease. They have been handicapped by the difficulty hitherto experienced in diagnosing to which type the individual case belonged.

The work of Dandy and Blackfan, along with their use of phenolsulphonephthalein to demonstrate the type of disease present (p. 652), seems likely to inaugurate a more hopeful era in the surgical treatment of the disease, and gives us reason to hope that much better results will soon be forthcoming. In simple cases of obstruction due to obliteration of the foramina of Magendie and Luschka, the prospects of cure by opening up a free exit for the fluid from the 4th ventricle should be fairly good. When the blocking is due to obliteration of the aqueduct of Sylvius its relief by opening up this channel is possible but

[1] *Trans. Med. Chir. Soc. Edin.*, 1905, xxiv., 187.

much more difficult. In communicating cases, where the defect consists only in obstruction to the free passage of fluid to the absorbing subarachnoid surface, something might also be done by operation; but where the defect consists in a diminished power of absorption in this area nothing can be effected by operation, unless the fluid can be drained into other tissues which have an adequate power of absorption.

It is impossible to say how far these indications can be successfully carried out until further reports of the results of operation have been published.

CHAPTER XXXII

ON MENTAL DEFECT (*AMENTIA*)[1]

LIKE "paralysis," "fever," and "diarrhœa," the term "mental defect" does not, properly speaking, designate a disease, but only a symptom which may be caused by many diseases. It is, however, from its nature, such an overwhelmingly important symptom that it overshadows all the other manifestations of disease that are present, and the children who show it are generally spoken of simply as idiots or imbeciles, irrespective of the difference in the lesions which have made them so.

The words "idiocy" and "imbecility" have naturally very unpleasant associations, and they should never be used in the hearing of the child's relatives. Dr Tredgold has done good service by reintroducing the word "amentia," which serves to denote all degrees of imperfect or arrested mental development and has no unpleasant associations for the lay mind.

Classification.—In endeavouring to classify cases of mental defect, we have two very different ends in view. These are (1) the *certification and grading* of the children for special classes and for training and custodiary institutions, and (2) the *increase of our knowledge* of the pathological lesions which have caused the amentia, and the clinical features associated with them. It is not possible at present to frame any single classification which will answer both these ends. The first mainly requires a grouping according to the *degree* or *character* of the mental defect, while the other calls for a classification that takes into account all *the pathological and clinical abnormalities* in the cases. We have, therefore, to use two forms of classification.

The *first* of these is represented by that laid down in the Mental Deficiency Act (1913). This aims simply at arranging

[1] I have to acknowledge much valuable criticism of this Chapter from my friend Dr R. D. Clarkson.

the children in groups according to the degree of mental defect present (as a librarian sorts his books by their size), and ignores altogether the nature of the abnormality which has made or is making them different from other children.

The Act divides all cases of mental defect into four classes, and supplies authoritative definitions of the precise meanings we are expected to attach to each of the terms which are in general use. These definitions are as follows:—

(*a*) Idiots; that is to say, persons so deeply defective in mind from birth or from an early age as to be unable to guard themselves against common physical dangers;

(*b*) Imbeciles; that is to say, persons in whose case there exists from birth or from an early age mental defectiveness not amounting to idiocy, yet so pronounced that they are incapable of managing themselves or their affairs, or, in the case of children, of being taught to do so;

(*c*) Feeble-minded persons; that is to say, persons in whose case there exists from birth or from an early age mental defectiveness not amounting to imbecility, yet so pronounced that they require care, supervision, and control for their own protection or for the protection of others, or, in the case of children, are incapable of receiving proper benefit from the instruction in ordinary schools;

(*d*) Moral imbeciles; that is to say, persons who from an early age display some permanent mental defect coupled with strong vicious or criminal propensities on which punishment has little or no deterrent effect.

Such definitions are very useful, indeed necessary, for practical purposes, but they are rather inadequate in that they ignore differences in disposition of the children, and draw no distinction between those who are simply deficient in intellect and those whose mental processes are also characterised by a striking want of balance. They are also defective from a practical point of view, in that they include along with ordinary *aments*—*i.e.*, idiots, imbeciles, and feeble-minded persons who have been so from birth—a certain number of juvenile *dements*—*i.e.*, children who are in the process of losing the intelligence they were born with, as the result of congenital syphilis or epilepsy. This is a weak point in the definitions because, while in all but the worst cases of amentia there is a probability of some improvement following suitable education, in dementia, the intellect is steadily deteriorating and the children are generally injured by any attempt at teaching.

In America the term "feeble-mindedness" is used in a wider sense than in this country, and denotes any degree of

mental defect; and the word "moron" has been applied to the milder cases which we call "feeble-minded."

The *second* form of classification is illustrated in the accompanying table taken from Dr Tredgold's book[1]. It is, in some respects, a modification of that drawn up by the late Dr Ireland, and is the most useful I know:—

Etiology.			Clinical Varieties.
PRIMARY AMENTIA.	A numerical deficiency, irregular arrangement, and imperfect development of cortical neurons.		1. SIMPLE AMENTIA. 2. MICROCEPHALIC. 3. MONGOLISM.
SECONDARY AMENTIA.	I. GROSS CEREBRAL LESIONS.		4. CONGENITAL SYPHILITIC. 5. AMAUROTIC. 6. HYDROCEPHALIC. 7. PORENCEPHALIC. 8. SCLEROTIC. 9. PARALYTIC. 10. Other TOXIC, INFLAMMATORY, and VASCULAR.
	II. DEFECTIVE CEREBRAL NUTRITION.		11. EPILEPSY. 12. CRETINISM. 13. NUTRITIONAL. 14. ISOLATION.

In this table there is first an important division of the cases into two great groups:—(*A*) The *primary* cases, which depend on an original incapacity of the cerebral neurons for proper development; and (*B*) those in which the defect is *secondary*, being due to the development having been arrested at a later stage by some extraneous or accidental cause. In these, the cause to which the defect of the neurons is secondary may have occurred during intrauterine life, at the time of birth, or during early childhood.

The primary group is said to include from 85 to 90, and the secondary, 10 to 15 per cent. of all the cases. This statement refers to children of school age. Among cases seen in infancy, the proportions of the two groups would probably be better given as 60 and 40 per cent. respectively. The difference is due, partly to the large number of the secondary cases that die during the first few years of life, and partly to the great

[1] *Mental Deficiency*, London, 3rd Edit., 1920.

difficulty there is in recognising slight cases of the primary variety during infancy.

On the right of the table, the most important of the clinical varieties are enumerated. The last two, and also most cases of cretinism, should perhaps rather be ranked as instances of "acquired mental dullness." Complicated cases which seem to belong to more than one of these types are not uncommon.

All the forms of disease which seriously damage a child's mental powers also lessen his resistance to disease and death; hence a large majority of mentally deficient children die within a few years of birth. We see therefore many more infants than older children affected in this way, and many more children than adults.

Before considering the more important of the different types of mentally defective children, we shall deal with the diagnosis and treatment of the condition in general.

The Diagnosis of Amentia.—The symptoms by which we recognise the presence of mental defect in infants and in young children are as largely bodily as mental. They may be divided into four groups, summarised as follows:—

1. Some children present from birth or early infancy such *an abnormality of bodily conformation* as proves them to be subjects of a disease of which mental defect is a cardinal symptom. Recognition of the fact that a child is suffering from mongolism, from a severe degree of cretinism, chronic hydrocephalus or spastic diplegia, or has an abnormally small head, implies a diagnosis of mental deficiency. In these cases the opinion that the patient is the subject of amentia can therefore often be confidently formed long before he is capable of showing mental peculiarities, and some idea of the degree of his probable improvement may sometimes also be possible.

There are a series of *minor bodily malformations*[1] on which much has been written as indicating a tendency to mental defect. Such are abnormally vaulted and cleft palates, hare-lips, defects of the rim of the ear, differences in shape of the two ears, marked epicanthic folds at the inner corner of the eyes, spina bifida occulta, congenital malformations of the heart, and many others.

All these defects may be met with in children of excellent

[1] See *The Study of Children*, by Dr F. Warner, London, 1897.

intelligence, but they are more common in the mentally defective. The fact of their presence may constitute slight confirmatory evidence of imbecility, but alone it can never be of any importance.

2. The *periodic recurrence of convulsions* is often associated with the presence of mental impairment. This may be the result of the fits, but more frequently it is merely another manifestation of the organic brain disease or defect which is causing them. Fits are a common symptom in almost all kinds of amentia. They may be of the regular epileptiform type; but often, in young infants especially, they consist, to begin with, merely in a sudden start, the head, arms, and legs being momentarily jerked forwards. With these slight attacks there is a temporary loss of consciousness, and there may also be a little stertorous breathing; after them the child usually cries as if he were distressed (p. 547).

3. The abnormal state of the child's intellect is often most plainly betrayed by *gestures and actions which are altogether abnormal*, showing that the mind, as Dr West puts it, is not only dwarfed but deformed. Thus, in young babies we may have abnormal fretfulness with constant causeless crying. I have known several such infants who were dosed for weeks by myself or others, and not a few who were circumcised, under the impression that they were suffering from bodily pain, before the real cause of their crying was discovered. Again, there may be gaping movements of the jaw, or a constant restless rolling of the eyes, the baby never looking straight at anything as a healthy child should do. Sometimes there is unmeaning laughter with exaggerated gestures, wayward and impulsive actions, or perhaps dirty and disgusting ways of eating. Continual dribbling of the saliva is another common symptom; and constant protrusion of the tongue in a young baby is a very suspicious sign, and may be the first indication noticed of mongolism or cretinism. Often we find utter apathy, with absence of the natural reflex muscular movements, so that the baby feels like an inanimate object in his nurse's arms when she tosses him up and down, instead of making springing movements with the limbs in his enjoyment of the motion, as a normal infant does.

4. The above-mentioned grosser indications of intellectual defect may be absent, and the diagnosis may have to be

founded on the degree of *delay in the development of the bodily and mental powers* that is present, taken along with the surrounding circumstances. Thus, we must think of mental defect whenever an infant is very long in learning to hold up his head, to sit, to use his hands, to stand and to walk, and especially if he does not show the natural desire of the healthy child to exercise all his developing motor faculties. Or again, though his eyes and ears are normal, if he does not seem to notice things, and is backward in responding to the touch, the smile, or the voice of his mother or nurse, and at a later stage is backward in speaking. Undue delay in acquiring the usual degree of control over the action of the bladder and bowel is another circumstance which may arouse suspicion as to the state of the intellect. Occasionally the earliest abnormality noticed in a mentally defective baby is unwillingness to suck.

Backwardness in the acquisition of these natural actions and gifts may of course be due merely to temporary debility accompanying or following bodily illness, and this frequently happens. If, however, they are very long in coming, and the child shows no sign of debility to account for his backwardness, we shall probably be right in attributing it to mental defect.

Acquired Mental Dullness.—Delay in mental development, without mental defect, is occasionally met with, and is apt to be mistaken for imbecility. We find it, for example, in weakly cripples as the result of isolation, with lack of teaching or other mental stimulus. Defects of sight and hearing may lead to a similar result. In such cases, when the abnormal conditions are removed, the mind may develop normally. Sometimes the backwardness is due to such debilitating maladies as chronic diarrhœa, severe rickets, or congenital syphilis. These children sometimes look very like imbeciles, but we are aided in our diagnosis if we investigate their condition as to common-sense, a feeling of responsibility, and general correctness of behaviour.

Another small group of children whom I have known to be mistaken for mental defectives consists of those who have temporarily lost their brightness, and sometimes also many of the signs of normal intelligence, as the result of a nervous break-down. Such a break-down may be caused in neurotic children by prolonged worry and overwork, along with a lack of

sympathy and affection on the part of those who are looking after them (p. 570).

The *treatment* of cases of acquired dullness, either from ill-health or from overstrain, is very different from that of mental defect, for in the former the patient is always to be treated as a sick child and not as a pupil. What his brain needs is rest and recreation—not instruction, however skilful. His bodily health must be fostered by a prolonged period of tranquil routine, which should include plenty of sleep, simple amusements, warmth, massage, tonics, nourishing food, and abundance of open air. In the cases which follow mental overstrain, while the bodily vigour is being restored and the mind left fallow, the child's feelings must be soothed by kindly mothering and encouragement. The result of such treatment is generally most satisfactory; but in planning the patient's future career, the weakness of his nervous system must be remembered and an occupation chosen which will not throw too much strain upon it.

Treatment of Amentia.

With regard to the treatment of mentally deficient children, two general statements may be made—

1. The condition is, strictly speaking, incurable, in the sense that children who are mentally defective to begin with will remain so to the end, whatever is done.

2. There are very few mentally deficient children who are not capable of being improved and made happier by suitable treatment.

These two statements are equally true, but the latter is much the more important as a basis of action.

The presence of a mentally defective child in a family is always, sooner or later, the cause of much distress. It is the duty of the medical man to do what he can to lessen this; and it is to be borne in mind that the treatment should include not only the child who is causing the suffering, but also the parents who are feeling it.

When a baby is mentally defective, and his parents do not know it, the first question that arises is: Are we to tell them? If they ask plainly, they must, of course, be told the truth. If, however, as often happens, they ask no direct questions (either

from ignorance or because they are afraid of the answer), it is usually far better to tell them nothing. There are two reasons for this apparently disingenuous course of action—(1) A very large proportion of imbecile babies die early. When this happens, it is clearly well for all concerned when the child's defect has remained a secret known only to the doctor. (2) The parents usually know nothing about the subject of mental deficiency. When this is so, a sudden intimation that it is present in their child, if made before their own observation has prepared them to receive it, is apt to produce unsatisfactory results. They either will not accept it, or, if they do so, it causes such discouragement as to paralyse their efforts for his improvement.

Whether the parents realise the significance of their child's backwardness or not, the main thing is that they should turn their attention actively to what can be done to improve him. It is by trying to make him do things better that they will come to see the true state of the case. They should, however, be told plainly that the expectation of sudden unworked-for recovery at seven, or fourteen, or any other age, is an utter delusion.

The extent to which mentally defective children benefit from treatment, and the best measures to employ, vary greatly according to the degree of the defect and the nature of the case. In most varieties of the condition, the improvement under bodily and mental culture is remarkable; and, even in the type of idiocy lowest in habits and capacity, the child may benefit greatly from an intelligent mother's early training.

The object of our treatment, so far as the child is concerned, is to make him as happy and as good as possible. As his happiness will largely depend on how many things he can and does do and notice, and on how he commends himself to others by his behaviour, our chief aim is to make him more capable and likeable. We must also try to give him some sense of duty proportionate to his intellect, and to show him that his duty lies in doing things that he is quite able to do.

It is sometimes an advantage to give the parents a few simple suggestions in a printed form. An example of such directions for the mothers of mentally defective babies and

little children will be found in Appendix H. It will be noticed that these are carefully worded so as to leave the question of the mental condition of the patient entirely open, so that they may still be of use to those mothers who continue to deny that their child's mind is affected.

An excellent little book on the early treatment of mentally deficient children has been published by Miss Margaret MacDowall, which will be found very helpful by anxious mothers.[1]

The following suggestions refer chiefly to young children (under five or six years). It is mainly at first that the mothers require assistance; and the training cannot be begun too early.

The main indications for treatment may be stated as follows:—

1. *Attend to the General Health.*—This includes the giving of good plain food, and attention to the teeth and to the bowels, much open-air exercise, frequent baths, and especially warm clothing, for the child will always be duller if he is feeling cold.

If epilepsy or cretinism is present, special treatment is, of course, indicated. It is also important to treat such conditions as rickets, anæmia, tuberculosis, and dyspepsia, which may greatly interfere with the child's mental as well as with his bodily vigour. Local defects, such as refractive errors, adenoids, and contracted tendons, are often well worth attending to in these children; and massage is often, and electricity occasionally, useful. Craniectomy has proved of no value whatever, and to what extent surgical operations for chronic hydrocephalus are likely to be of benefit to the intellect is still doubtful.

2. *Awaken the Child's Faculties, (a) Bodily and (b) Mental.*

(*a*) The child must be encouraged in the *voluntary use of all his muscles* regularly and carefully. Such exercises are not only good for improving his strength and co-ordination, but

[1] *Simple Beginnings in the Training of Mentally Defective Children*, London: Local Government Press Co. (R. T. Peach), 1919. The reader will also find wise and helpful suggestions in the Appendix by Miss Mary Dendy in Dr C. P. Lapage's book on *Feeblemindedness in Children of School Age*, 2nd Edit., Manchester, 1920.

are also helpful in stopping the purposeless automatic movements which so many of these children have. Musical drill, dumb-bells, ball games, skipping, bean-bags, walking between the steps of a ladder, nail-boards, threading beads, and all sorts of kindergarten occupations, are useful for the older and more intelligent of the children, as well as singing and reciting. For young children, and those who are less capable, such simple actions as clapping hands or playing with a rattle, may to some extent answer the same purpose. It is very important to teach the child chewing if possible; and if he dribbles, his lips may be strengthened by exercises, such as holding a flat piece of wood transversely between them for a given time, and by blowing whistles, trumpets, etc.

(*b*) Teach him *to notice things* and to compare their characters—roughness and smoothness; hardness and softness; heaviness and lightness; heat and cold; colours; shapes (circles, squares, triangles, spheres, cubes, cylinders, etc.); distances; sounds (musical and other); tastes and smells. Take him out or to the window, and let him see the people, horses, dogs, cars, etc. If objects do not attract him, perhaps bright light and bright colours will. Find out what arouses his attention, and let him have it. Encourage him to look at, listen to, and handle anything that he is taken up with. Any sort of interest will help to brighten him.

3. *Encourage him to use his Awakened Faculties in giving himself Pleasure.*—Remember that he needs to be taught to do many things which normal children do of their own accord without teaching. Incite him to try to do things; and, at first, plan easy successes for him. If he deliberately wants a thing, tries to get it, and succeeds, this is a most valuable and a very pleasant lesson for him. In the case of a baby, if he likes a noise, give him a key and a pot-lid and let him make it for himself. Never let the mother or nurse go on doing for the child anything that he can be made to do for himself. For most mentally defective children, mere memory knowledge is of little use, but the more things they can do the better for them.

4. *Promote Self-Control.*—This is of immense importance and very difficult. It includes a number of things. There is, firstly, keeping himself clean and letting his mother know when he requires to be attended to. Some mentally defective

children cannot be taught cleanly habits at all. A great many, however, who seem to have complete incontinence in early childhood, may, with perseverance in training, become quite normal in this respect in time. General personal cleanliness and tidiness in person and dress are also to be constantly insisted on. The acquisition of good manners, including good temper, and of decency of conduct is, in most cases, of far more consequence to the child's future happiness than learning to read and write; and the ability to speak clearly and nicely, and to use a knife and fork like other people are for him valuable accomplishments. Another point of great importance is that bad habits of all kinds, to which these children are particularly prone, must be watched for and checked at their earliest beginning. This applies not only to such things as rocking to and fro, masturbation, thumb-sucking, and dirt-eating, but equally to little tricks of manner and expression (grimacing, unrestrained gestures, making unpleasant noises), which do the children much harm by drawing attention to their defect and making them objectionable to others.

Thoroughness in everything, so far as it is practicable, is of inestimable importance. The mother must never acquiesce in the child's doing less than his best, because he is weakly.

5. *Cultivate the Moral Character.*—Prompt obedience is as all-important in the education of character in the mentally defective, as it is in ordinary children. Ideas of justice, honesty, truthfulness, affection, modesty, unselfishness, and gentleness to younger children and animals, can generally be inculcated to some degree, for there are few mentally defective children who have not some sense of right and wrong to be developed.

6. *Encourage the Child's Affection.*—Always cultivate every proper feeling of love to others that the child is capable of. To be liked by others is one of the important sources of human happiness; but another, which is even greater, is the feeling of liking for others. Few things brighten a child's life more than having many objects of affection, whether they are human beings, or only animals and dolls.

The Question of Institution Treatment.—To most mentally defective children under six or seven years in satisfactory homes, a mother's care and affection mean more than any-

thing that the best institution can supply; and after this age, there are some cases happily situated of whom the same is true, and who also, like the younger ones, are better off at home than anywhere else.

In the great majority of instances, however, there is much to be said in favour of the child being sent early to a suitable institution or special boarding-school. Many of these children suffer permanently from this not being done.

In discussing what should be done with the child, we have to bear in mind his home conditions, his present needs, and the arrangements that are likely to be possible for his future care.

1. *The Home Conditions.*—The interests of the parents and those of the other children have to be considered as well as those of the child. Although his presence in the house may do no direct harm to his brothers and sisters, he often makes such demands on his mother's time and energy that she cannot give enough attention to the other children. As the mentally defective child grows older, also, the association with his normal playmates may become a constant source of discouragement to him, because he finds himself hopelessly inferior to them at every turn. Further, unless the house is so situated as to afford a considerable amount of privacy, and the mother has extra assistance, it is often impossible for him while staying at home to enjoy the freedom and open-air exercise that he needs for his health and happiness.

If the home arrangements are not altogether satisfactory, the strain on the mother is apt to be very great. She is probably suffering severely already from disappointed affection, and from the shock of her growing realisation of the child's infirmity; and her strained nerves tell inevitably on him, making him more restless and difficult than he would be in charge of one who did not feel so keenly about him.

2. *The Child's Present Needs.*—All mentally defective children need protection from the difficulties, dangers, and distresses of life. During the early years, a well-ordered home supplies all that is needed in this direction; but often, as the child grows up, it becomes increasingly difficult if not impossible to shield him, or her, from trouble while living at home.

For higher grade mentally defective children, skilled training—mental, physical, and manual—is very important.

It helps in developing their intelligence and increasing their feeble initiative, and it brightens their lives by making them more like others. It can, in most cases, be much better provided in a special boarding-school than at home. Life in an institution has also the great advantage that it allows the child to associate on equal terms with companions like himself, and to have the great and wholesome pleasure of excelling some of his playfellows in something or other. The anxiety which some parents feel lest their child should be deteriorated by living with others less intelligent than himself, is quite groundless, if there is proper supervision.

Daily attendance, for a few hours, at a special school is sometimes proposed as an alternative to sending the child away from home; but the influence of such schooling is very small indeed compared with that of a residential institution.

3. *The Child's Future Needs.*—Even when the home conditions are ideal during early childhood, it may be far the best and kindest thing in the end to send the patient early to an institution, unless it is certain that as he grows older he will always be equally well looked after at home or with friends. While he is young, he will probably soon learn to live happily under new rules and restrictions; but this may be very difficult for him if he leaves home for the first time when he is older and his habits have become more formed.

Simple Primary Amentia.

The group of simple primary amentia includes the large majority of mentally defective children. Its size is mainly due to the cases which properly belong to it being far commoner than those of any other type. It is also due, however, though to a much less degree, to a considerable number of cases, which are not really of the same kind, having been put into it provisionally, simply because their real nature is, as yet, so obscure that we do not know where else to put them. Various groups of mentally defective children, that used to be classed along with simple primary amentia, have now been differentiated; and there are still a number of others which, when further investigated, will probably require to be placed in separate classes.

The **causation** of simple primary amentia is obscure.

Certainly a neurotic heredity has much, and parental alcoholism and tuberculosis have little, to do with it.

Symptoms.—As the condition is not, in its lesser degrees, characterised by paralysis or by any gross visible fault of bodily conformation, it is often difficult if not impossible to recognise it in early infancy. Severe cases, however, are easy to distinguish soon after birth. The babies show too little of the normal automatic movements of healthy infancy, and their voluntary motor faculties and speech fail to develop at the proper times. Often also they obviously do not feel, hear, or see like healthy children. Most of the bad cases do not recognise their own mother's face; many do not know her voice and only recognise her, if at all, by the way she handles them. Their gestures and behaviour, even as infants, are strikingly abnormal, and if they gain control over their bladder and bowel at all, they are very late in doing so. A large proportion of these children take frequent epileptic attacks.

As they grow older, their weaknesses become increasingly obvious. When they learn to talk, their speech is usually more or less indistinct and defective. In many cases there is a constant dribbling of saliva from the mouth. When they walk, their gait remains clumsy and like that of a younger child. They go with their heads forward and their arms hanging in front; their feet are planted far apart, their pelvis often moves too much in walking and the joints of their lower limbs too little. Their hands are generally flabby and nerveless. They are difficult to teach, because they are unable to concentrate their attention on one subject for any time; and they cannot persevere, even in things which interest them. Many of them seem to have no common sense at all, and do not realise their position or their proper relation to others. Some, chiefly those who take fits, are altogether without the normal shyness of childhood, and others are morbidly shy and self-conscious. They are apt also to show lack of self-control, to laugh and cry without sufficient reason, and to get into sudden unreasonable fits of passion. Many of them, as they grow older, show a persistent tendency to wander from home without any apparent aim.

Diagnosis.—Children of this class, who are but slightly affected, make up the majority of the "Mentally Defective Children" in the Special Classes of the Elementary Schools.

Such slight cases are often not recognised as abnormal in early infancy, because they have wits enough to perform passably all the duties required of ordinary babyhood. As they grow up, however, more is expected from them, and their shortcomings become increasingly obvious. They are generally slow in learning to walk and to speak. In outward appearance there may be little amiss, but often their heads are distinctly too small and the frontal region especially poorly developed. Their gait also is apt to show, to some extent, the peculiarities already alluded to.

In many of the slighter cases the deficiency is mainly noticed, while they are children, from the incompetent way in which they do their school work, both mental and manual. They remain far behind normal children of their own age. If a child who has had fairly good health, and with whose education special pains have been taken, is not able to pass the Fourth Standard by the time he is fourteen, he may in most cases, as Dr Clarkson has suggested, be fairly classed as mentally defective.[1]

In after life the weakness in will-power and in self-control of these individuals is very noticeable and renders them unfit to undertake the responsibilities of independence. When left to themselves, they almost invariably come to grief in one way or another. If, however, they are carefully looked after from the first, and continue to be shielded from the temptations which they cannot resist, they may become, in a measure, good and useful citizens. So long as someone else is at the helm, to use Dr Tredgold's apt simile, many of them can work their passage; although, for the most part, they are quite unable to steer their own course upon life's stormy sea. When these facts are realised by the public authorities, more money will be spent in residential institutions for the feeble-minded, and less will then be needed than is used at present for keeping them in workhouses, prisons, and Magdalene asylums.

[1] A normal child, under ordinary circumstances, should be ready to be promoted from the Infant Department when he is about seven years old. The average age at each Standard may be given as follows:—

Standard I. . .	7-8 years.	Standard V. . .	11-12 years.
„ II. . .	8-9 „	„ VI. . .	12-13 „
„ III. . .	9-10 „	„ VII. . .	13-14 „
„ IV. . .	10-11 „		

Microcephalus.

The term "microcephalus" is often applied to any child that has a small head. It is better, however, to restrict it to the small but well-defined group of cases which are sometimes called "true microcephalus." The main clinical characteristics of these children are a very small head with a narrow receding forehead, pointed vertex, and flat occiput (p. 58, Figs. 24 and 25), extremely early closure of the fontanelle, and an absence of any real paralysis. The brain is much too small, and some of its parts are out of proportion; it looks like that of one of the higher apes. It is of normal consistence and shows no areas of sclerosis, such as we find in cases of spastic diplegia from birth-injury.

Symptoms.—At birth the microcephalus may be overlooked, as the head is not relatively so small then; but it soon becomes evident, because the rapid growth, which adds 3 inches to the circumference of the normal child's cranium in the first six months, fails to take place. In well-marked cases the head measures from 14 to 16 inches in later childhood and adult life, and it is rarely more than 17 inches. In a few otherwise typical cases, however, the measurement may reach about 18 inches.

The frequent absence of the anterior fontanelle at birth, and its very early closure when present, are important points. Apart from the small forehead, the features are generally normal; the ears are large and often well-formed. The palate is usually abnormally arched, and the body and limbs are apt to be undergrown, though not otherwise abnormal. In the early months the extremities may show such an exaggeration of the normal hypertonicity of infancy that spastic diplegia may be suspected. The child is generally in his third or fourth year before he can walk alone. The teeth appear at the usual times.

The degree of mental defect varies greatly—generally in direct proportion to the smallness of the head. The worst cases are quite idiotic, and most are low-grade imbeciles. A few of the milder cases, in whom the head is not very small, are little more than feeble-minded. In most of the cases speech is scanty and late in beginning, and sometimes it is never acquired. Control of the bladder and bowel is also late

in developing. Convulsions are very common—they occur in more than a third of the children.

In bad cases the infant is apathetic and unobservant in the early months, and in later childhood of a low mental type, although his movements may be very active; he is not infrequently restless, inquisitive, greedy, and cruel to other children and animals. In some of the higher grade cases, however, there may be a kindly and gentle disposition and a considerable amount of intelligence. The recurrence of fits has, of course, a very unfavourable effect on the child's disposition and power of benefiting from education.

The **cause** of microcephalus is unknown. The mothers are often healthy young primiparæ. Occasionally more than one case occurs in a family.

The **prognosis**, both as to length of life and mental improvement, is generally unfavourable. The children are prone to take tuberculosis, and often die of it. Some of the milder cases reach adult life, and a few may be taught to earn their living under partial supervision.

Treatment.—While the worst cases are almost ineducable, training in an institution is very desirable for the less severe. A wholesome routine of pleasant occupations and an out-of-door life do a great deal to lessen the abnormal restlessness and tendency to convulsions.

Craniectomy was at one time recommended by some authorities. This advice was founded on a mistaken idea of the pathology of the condition; and experience has shown that the operation *never* does any good.

Mongolism (*Mongolian Imbecility*).

Mongolism is a common and well-defined disease which is always accompanied by mental defect. It is found in about 5 per cent. of mentally defective children of school age; but, among those young children who are brought to Children's Hospitals presenting recognisable signs of mental defect from an early age, the proportion is much larger—probably at least 20 per cent. This is partly accounted for by one of its prominent clinical features, which is a very *low degree of resistance* during infancy to most forms of infection; for something like three-quarters of the children die in the first few

FIG. 176.—Boy of 18 months.

FIG. 177.—Girl of 2 years.

FIG. 178.—Girl of 3 months.

FIG. 179.—Boy of 8 months.

FIG. 180.—Girl of $6\frac{1}{2}$ months.

MONGOLISM.

years of life from bronchitis, broncho-pneumonia, measles, whooping-cough, influenza, or some other ailment. The name "Mongolian Imbecility" was first given to this condition because the children's faces often resemble in some respects those of the Mongolian races.[1]

Although mongolism is classed along with simple primary amentia and microcephalus, because like them it presents an arrest of development of the primary neurons, this condition differs essentially from the other two groups in an important respect. In the typical members of both of them, the chief morbid condition is evidently a brain-lesion, which has only a very slight secondary effect, if any, on the rest of the body. In mongolism, however, the morbid condition is altogether general in its distribution. The brain is not like that in normal children, but the other parts of the child's body are quite as peculiar as the brain. To put it otherwise—if one found the body of a case of simple primary amentia or of microcephalus without the head, one could not recognise the condition; but, if the headless body was that of a mongol, no one who was familiar with the characteristics of mongolism would have much difficulty in making a diagnosis.

Symptoms.—The main physical characteristic of mongolism consists then in the peculiar conformation of the whole body. While this is so, the special form of the face is the clinical feature which is most easily recognised (Figs. 176 to 182); indeed there is usually no difficulty in recognising it even at the time of birth.

The child's features are small and rounded and, like the other extremities, reddish in tint. The cranium is small and round (brachycephalic), and strikingly devoid of eminences. The eyes are often too near one another, and in most cases the axes of the palpebral fissures are abnormally oblique—the outer canthus being higher than the inner. In a large proportion, also, there is a marked development of the epicanthic fold of skin at the inner angle of the eye. Nystagmus is present during infancy in about 10 per cent. of the cases. It is sometimes of the permanent conjugate type, and oftener of the temporary convergent or irregular variety (p. 550), in which case it is frequently accompanied by head-nodding. A peculiar

[1] J. Langdon Down, "Ethnic Classification of Idiots," *London Hosp. Rep.*, 1866, iii., 259.

FIG. 181.—Mongolism. Boy of 3 years. Obliquity of eyes and protrusion of tongue. (Dr Melville Dunlop's case.)

FIG. 182.—Mongolism. Girl of 9 years. Fissuring of tongue. (Dr Melville Dunlop's case.)

spotted form of lamellar cataract is not uncommon in older mongols.[1] The nose is snubbed and the nostrils often sharply triangular in outline. They are frequently also narrowed owing to chronic naso-pharyngeal obstruction.

The mucous membrane of the lips is often dry and crossed by numerous vertical fissures which do not extend on to the skin like those in congenital syphilis. The teeth are generally small, and tend to become yellow and to decay early. In many cases the central incisors are rotated so that their anterior surfaces form an angle with the concavity forward.

The tongue in many cases protrudes from the mouth as if it were too big. This, however, is due to the shortness of the oral cavity rather than to an abnormal length of the organ. During the early weeks of life, its mucous membrane is quite normal in appearance. As the child grows, however, the papillæ enlarge until—between the third and ninth month—the mucous membrane has a raw and granular surface. Later—generally during the third or fourth year, but sometimes as early as the second—deep fissures form on the dorsum (Fig. 182). In more than 90 per cent. of all mongols over six years, this fissuring of the tongue is a marked symptom; and it is of special interest because, unlike most of the other peculiar features of the disease, it is acquired and not congenital. Although its development may be favoured by a congenital vulnerability of the mucous membrane, its main cause is certainly the persistent and forcible sucking of the tongue which these children practise.[2] The same condition may be found in any child who has practised this habit energetically for a long time.

The ears are in most cases small, rounded, and simply convoluted ("shell-shaped"), and they often project more than usual. The hair is normal in infancy, but is apt to become dry and scanty in older children. Alopecia areata is common, and sometimes there is complete baldness. The skin, especially on the limbs, often shows an exaggeration of the normal mottling of childhood.

The state of the limbs is characteristic, they are soft and small-boned, and the joints have unusually lax ligaments, so

[1] Pearce, Rankine, and Ormond, *Brit. Med. Journ.*, 23rd July 1910, ii., 186.

[2] Thomson, *Brit. Med. Journ.*, 4th May 1907, i., 1051.

that they can be easily hyperextended. The shape of the extremities differs from that in cretinism. The wrist and hand are small and the latter very soft, owing to the small size of the bones and the laxity of the ligaments. The fingers are rather thick for the size of the hand, but not so square-pointed as those of cretins, nor is their skin wrinkled and redundant to the same extent. The little finger is often dwarfed and shows an exaggeration of the normal curve toward the mesial line.

Malformations of various parts of the body are frequently met with—such as club-foot, cleft-palate, and hare-lip, cubitus varus, syndactyly, dwarfing of the terminal phalanges with deformed nails, hypospadias, congenital stenosis of the intestine, and others. The most remarkable fact is the extreme frequency of congenital malformation of the heart to which attention was first drawn by A. E. Garrod.[1] Among 223 cases, of which I have notes, 37 (*i.e.*, 12 per cent.) showed physical signs of this. In most of those which I have examined post-mortem, there has been patency of the interventricular septum, with or without other defects.

Delay in the growth and development of the body is also characteristic. The stature is usually stunted, so that the child looks much younger than he really is; and as he grows older the dwarfing becomes more noticeable.

The dentition is generally backward. In two-thirds of the cases, the first teeth do not appear until after the end of the first year, and often not till eighteen months or two years. In the rest, the first few teeth come quite early, but the later ones are delayed or irregular in the time of their appearance. The fontanelle rarely closes before the third or fourth, and is sometimes still patent in the fifth or sixth year. The voluntary muscular movements are late in being acquired, so that the baby does not hold his head up until the sixth, or even the ninth month, nor sit until the second year or later. He generally does not walk alone before the third or fourth year. The grasp is also feeble and fumbling. Speech is slow in being acquired and is guttural and indistinct.

The mongol's *disposition and character* are also peculiar to himself. Except in a few of the worst cases, they are happy, good-tempered, and very affectionate children—bright,

[1] "On the Association of Cardiac Malformations with other Congenital Defects," *St Bart. Hosp. Rep.*, 1894, xxx., 53.

inquisitive, and apt at mimicry. They are generally cleanly and methodical in their ways from early infancy.

Their *tendency to acquire infectious complaints* has been already referred to; and they are very prone to suffer from catarrh of all the mucous membranes. Blepharitis occurs in at least 75 per cent. of the cases; and catarrh of the nose, naso-pharynx, fauces, and vulva are very common. As the naso-pharyngeal cavity is often very shallow, so that the vomer almost touches the back wall of the pharynx, a very small amount of adenoid growth leads to obstruction.

Fits sometimes occur, but not so frequently as in most other varieties of imbecility.

Diagnosis.—The distinctive physiognomy of mongolism depends on the numerous small peculiarities of conformation which we have already described in the head, face, hands, and body generally. Practically, however, we diagnose the mongol mainly from his striking resemblance to other mongols, just as in other children we recognise the indications of Negro, East Indian, or Jewish parentage. They are always very like other mongols and very unlike their own brothers and sisters. The respects in which they differ from other children are comparable with, though less than, the differences between a chimpanzee and an orang-outang. In fact, they look as if they belonged to a distinct species of the human race.

Prognosis.—In answering questions as to the child's future capabilities, it must be remembered that mongols almost always improve considerably in the course of years, and sometimes make an unexpected degree of progress under careful training. From the first, however, it may be foretold that, though they will always remain imbeciles, they will be cleanly in their habits and amiable and affectionate in disposition. Those of a higher grade may in time be taught to read and write, and to conduct themselves almost like ordinary children in their home life; but they will never be able to earn a living. I have known one instance of a mongol girl who was married when she was twenty-eight, and had on two occasions what seemed to be a miscarriage; her husband died within a year. So far as I know, there is no case on record of a mongol having borne a child.

Causation.—Considering that the condition is so common, it is curious how few definite facts we possess to help us in

framing any plausible theory of its etiology. It has been described, with some probability, as due to *an arrest or perversion of the normal development;* and it is in keeping with this view that fully one-half of the mothers of these children are in their fortieth year or older, at the time of their birth, and that an equally large proportion of them have come at the end of large families. There are, however, many exceptions to this, for no fewer than 7 per cent. of 156 cases in which these points were ascertained were the first children of apparently healthy women under twenty-five.

Congenital Syphilis in Relation to Mental Defect.

The proportion of children met with in Imbecile Institutions who show indubitable signs of congenital syphilis is usually from 1 to 2 per cent. In the practice of Children's Hospitals and dispensaries, however, the proportion of mental cases, with evidence of syphilis is larger than in institutions. This is because many of these children die before they are old enough to be sent to institutions, and such as survive are often kept at home because of their infirmity and obvious inability to benefit from any special training.

Congenital syphilis may cause mental defect in many ways:—

(1) Like any other weakening influence, it may *interfere with the development of the cerebral tissues*, producing either a deformed brain or ill-grown brain-cells. In recent years, a number of writers have endeavoured to show, by the use of the Wassermann test, that many mentally defective children who present none of the usual signs by which congenital syphilis is recognised, nevertheless owe their condition to this cause. In a few instances, the diagnosis made in this way has been followed by surprising improvement in the mental symptoms from the use of salvarsan or one of its equivalents. So far, however, the results of the Wassermann test arrived at by various observers have differed from one another to such an extraordinary extent that the question must still be regarded as quite unsettled.

(2) Occasionally we see children with hemiplegia and other forms of paralysis, with amentia, which are apparently due to syphilitic *endarteritis* of the cerebral vessels.

(3) *Chronic Hydrocephalus* is not very uncommon in syphilitic babies, and often recovers satisfactorily under specific treatment.

(4) *Intracranial Gummata* are sometimes met with, though they are very rare.

(5) Ashby has described a form of Jacksonian convulsions in babies with congenital syphilis, which depends on the occurrence of *acute meningo-encephalitis* of the cerebral cortex and ends in sclerosis and severe amentia (Fig. 183).

(6) The commonest and most interesting intracranial disease of specific origin in children is the chronic meningo-encephalitis, the morbid anatomy of which is similar to that found in adult general paralysis,[1] and which gives rise to *Progressive Dementia* in older children.

FIG. 183.—Idiocy from Congenital Syphilitic Brain Disease. Girl of 8½ years.

Progressive Dementia (*Juvenile General Paralysis*).—Congenital syphilitic meningo-encephalitis usually begins very insidiously. Its first symptoms may appear as early as the fourth year, or even before that age, but most of the patients are at least six or eight years old; and girls are more often affected than boys. The disease may set in in children who had previously seemed quite normal; but, in the majority of cases, indications of mental defect have been present from early infancy.

Symptoms.—When this disease begins in childhood, its main bodily symptoms are those of advancing spastic diplegia, while the mental condition is one of simple steadily progressing deterioration. Along with the paralysis and dementia, there is usually increasing debility with spastic diplegia and contractures, and there may be severe pains in the back and limbs; often, also, there are recurrent convulsive seizures ("congestive attacks").

[1] Thomson and Dawson, *Lancet*, 16th Feb. 1895, 397; Thomson and Welsh, *Brit. Med. Journ.*, 1st April 1899, 784.

In older children (from eight to twelve) we may also meet with cases of this simple type, and it is well to remember that either acquired spastic diplegia or progressive dementia in children of school age is generally due to this cause.

The more typical cases of juvenile general paralysis are found in older children and adolescents. In these the early symptoms often consist in attacks of severe headache with vomiting, or in ill-defined epileptiform congestive attacks. Sometimes there is only a passing loss of consciousness or of speech. Later, eye-symptoms develop. There may be irregularity in the shape and size of the pupils and loss of the pupil reflexes; optic atrophy sometimes occurs. The knee-jerks are greatly exaggerated and in some cases ultimately lost, and the plantar reflex gives an extensor response. Facial irritability is sometimes present in an exaggerated degree. In some cases a chorea-like tremor is one of the early symptoms, and the articulation may also be characteristically affected.

The mental deterioration is profound and steadily progressive; and the patient becomes more and more like a baby in her ways and loses memory, interest in outside things, and natural affection. If there are younger children in the house, she may be very jealous and attack them. Although hallucinations are apparently absent in the younger cases, there are sometimes, in the older children, a few of an elementary and childish sort. The defective speech and other symptoms get worse and worse, and the child becomes extremely emaciated and finally quite paralysed. The limbs develop severe contractures.

The duration of the case, if no intercurrent disease sets in, is very protracted, sometimes about two years, generally three or four, and occasionally as long as six or seven. In the older cases puberty is deferred and it usually does not appear at all.

No treatment, except that of bed-sores and other complications, has any effect.

Amaurotic Family Idiocy (*Infantile Cerebral Degeneration*).

This is a rare and fatal family disease of infancy which differs from all other known affections of the nervous system in being almost entirely confined to members of the Jewish

race.[1] The first case was described by Mr Waren Tay in 1881, and since then a large number of papers have appeared on the subject by B. Sachs, Kingdon, Risien Russell, and many others.

The chief symptoms are summarised as follows by B. Sachs:[2]—

"1. Mental impairment, observed during the first few months of life, and leading to absolute idiocy.

"2. A paresis or paralysis of the greater part of the body, and this paralysis may be either flaccid or spastic.

"3. The reflexes may be deficient or increased.

"4. A diminution of vision terminating in absolute blind-

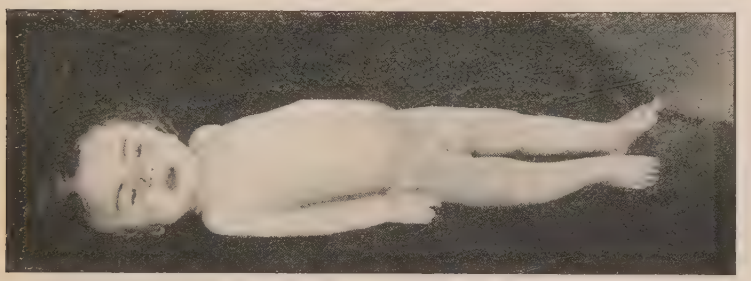


FIG. 184.—Amaurotic Family Idiocy. Late stage. (Dr W. B. Drummond's case.)

ness (changes in the macula lutea, and later on optic nerve atrophy).

"5. Marasmus, and a fatal termination, as a rule, about the age of two years.

"6. The occurrence of the affection in several members of the same family."

In some cases nystagmus, strabismus, and hyperacuity of hearing also occur. Convulsions are occasionally observed, but are not a characteristic symptom of the disease. The temperature is not affected, and nothing abnormal is found in the abdominal and thoracic organs.

The children appear to be perfectly well in every way till about the end of the third month. At that time the mother

[1] I have seen two infants of purely Scottish parentage who presented all the characteristic signs and symptoms of amaurotic family idiocy in the most typical way. Unfortunately a post-mortem examination was not allowed in either case.

[2] *New York Med. Journ.*, 30th May 1896, lxiii., 697.

may notice that the child's muscles, especially those of the neck, are getting weaker, and that he seems to see less than he did. By the fourth or fifth month the ocular appearances have developed. These are easily recognised, and are pathognomonic of the disease. A whitish grey oval patch, with its long axis horizontal, is seen in the macular region. It is about twice the size of the optic disc and is raised slightly above the general surface of the retina. In its centre is a small dark cherry-red spot. Later, optic atrophy sets in, and the child ultimately becomes quite blind as well as paralysed and idiotic (Fig. 184).

The etiology of the disease is quite unknown, and the pathology is still obscure. In a conjoint paper,[1] Drs Poynton, Parsons, and Gordon Holmes come to the conclusion that the cause is a primary affection of the nerve cells, due to some inherent biochemical property of the protoplasm of the cells. They are convinced that it is not the result of arrested development or of the action of bacterial toxins.

FIG. 185.—Idiocy from Infantile Cerebral Paralysis. Girl of 14 months.

The cases always end fatally, and no known treatment has any effect on their progress.

Amentia due to Gross Cerebral Lesions.

In any form of paralysis from cerebral disease or injury there may be some degree of mental impairment. In cases of cerebral diplegia (Fig. 185) and hemiplegia from meningeal hæmorrhage at birth or from injury, in polioencephalitis, and in chronic hydrocephalus following meningitis, the damage to the intellect may be very severe or comparatively slight, according to the parts of the brain damaged. Many slightly paralysed children who are by no means imbeciles have a slight

[1] *Brain*, 1906, xxix., 180.

degree of mental instability and emotional weakness, or a tendency to epileptic convulsions.

In cases of spastic diplegia the child has often considerable mental capacity and fairly good judgment. Occasionally, even when the limbs are very spastic and choreic, a surprising amount of manual education is possible. Some of these children develop great powers of perseverance, and may in

FIGS. 186 and 187.—Adenoma Sebaceum in Tuberous Sclerosis.
(Dr R. D. Clarkson's cases.)

time be taught to do quite difficult things—though, of course, never very deftly or gracefully.

Tuberous Sclerosis.

Tuberous sclerosis is a developmental disease of unknown causation, which is characterised clinically, by convulsions and mental deterioration; and anatomically, by numerous small rounded areas of sclerosis in the brain, and sometimes by a peculiar eruption in the skin of the face (adenoma sebaceum) (Figs. 186 and 187), and congenital tumours in various of the

internal organs. The condition was first described by Bourneville in 1880.[1]

The main *symptom* of the disease is the occurrence of general convulsions. These are apt to be numerous and severe, but apparently have no other peculiar characters. They often begin in early infancy, but are sometimes delayed until later childhood. Severe mental defect is generally present from the first; but, in some cases, the intellect only begins to suffer after the convulsions have lasted for years. The other manifestations of the disease are, as already mentioned, the presence of adenoma sebaceum (an eruption of little red nodules on the skin of the nose and cheeks), and isolated undiagnosable tumours elsewhere which usually contain embryonal elements. Such tumours have been described in the heart (rhabdomyomata), kidneys, thyroid, thymus, pancreas, mammæ, and duodenum. Spastic paralysis and contractures occasionally occur, and congenital malformations of the heart and of the central nervous system, such as spina bifida, have been described. When the skin is not affected, the *diagnosis* of tuberous sclerosis is merely a matter of conjecture; but probably all mentally defective children with epileptiform convulsions who have adenoma sebaceum are instances of this disease.

No *treatment* is of any avail; and the patients die either during childhood or in early adult life.

On the Relation of Epilepsy to Amentia.

True epilepsy, when it lasts for any time, always has a serious effect on the mental condition in childhood. An entirely sane epileptic child is very rarely seen. As the fits continue, the patient's character and disposition alter, and he tends to lose his natural shyness and to become forward, moody, impulsive, passionate, and irresponsible, and full of reckless mischief. Occasionally maniacal symptoms appear.

Epileptiform fits are common in practically all varieties of amentia, except in cretinism and mongolism in which they only occasionally occur. They are especially frequent in cases with gross naked-eye changes in the brain; and their frequency

[1] J. S. Fowler and Carnegie Dickson, *Quart. Journ. of Med.*, 1910, iv., 43.

usually varies in direct proportion to the severity of the mental defect.

In the large majority of cases of amentia with convulsions, the fits are due to the cerebral lesion which is causing the mental condition. In comparatively few is the intellectual weakness altogether secondary to the fits. In all cases, however, the occurrence of convulsions, whether primary or secondary, has a serious effect on the mental state, which deteriorates so long as they continue to recur, and tends to improve when they cease. Later, the excitement caused by the fits passes off and the condition passes gradually into one of dementia.

In regard to the child's education, the presence of epileptiform convulsions is always important; for even when the mental defect seems slight, the continuance of the epilepsy prevents all hope of permanent mental improvement by education. Some of the children show very considerable intelligence at first; but, as the disease progresses, they forget what they have learned, so that their schooling is generally a useless cause of worry and excitement to them. When such children are sent to an institution where they are not troubled with much brain work, the fits often become less frequent or cease for the time, owing to the healthy influence of the regulated open-air exercise, comparative freedom from restraint, and suitable occupations.

Moral Imbecility.

There can be no doubt that instances of grave moral defect associated with normal intellectual capacity are met with in later life; and the questions regarding their recognition and management are matters of very great importance as well as difficulty. This subject need not, however, be discussed here, for it is only after puberty that such problems are at all likely to arise.

If uncomplicated moral defect of this kind ever begins to show itself in early childhood, it certainly cannot be differentiated at this age from the temporary abnormal naughtiness we have already considered (p. 571). It is usually only after twelve or fourteen, when increasing freedom of action is bringing with it more opportunities of transgression, that cases of

permanent moral, without mental, defect can be diagnosed with any confidence.

Various degrees of moral defect are, of course, very commonly found in mentally defective children; and it is customary (as is done in the Act) to speak of those in whom the intellectual weakness is relatively slight, and the moral obliquity well-marked, as moral imbeciles.

It is probable that what is regarded as moral defect in these cases is, in a majority of them at least, nothing worse than the temporary naughtiness just referred to; although it is aggravated and made more difficult to deal with in their case by the presence of mental deficiency. The fact that punishment has no deterrent effect on these children does not distinguish their condition at all from that of the mentally normal ones, for they also, as we have seen, are not appreciably influenced by it.

The home treatment of mentally defective children who show much moral perversity is extremely difficult, if not impossible. When removed to an institution they generally improve very considerably.

CHAPTER XXXIII

ON SOME DEFECTS AND DISEASES OF THE MUSCLES

Congenital Pectoral Defect.

THE commonest form of congenital absence of muscle met with in practice is that found in the deformity known as "congenital pectoral defect." It is a condition which the practitioner should know about, because it is not very rare and is sometimes misinterpreted. It is always unilateral, and affects not only the muscles, but also all the various structures which normally occupy the pectoral region and its neighbourhood. The greater and lesser pectoral muscles are either quite absent or partially so, and the subcutaneous fat over them is scanty compared with that on the normal side. The mamma is either absent or very small; and occasionally, as in Fig. 188, there may be no trace of a nipple. In fully a quarter of the cases[1] there is also a defect in the wall of the chest which involves some of the ribs and cartilages (Fig. 189), and sometimes also the adjacent margin of the sternum. The defect is generally found somewhere between the second and fifth ribs. Its size and shape vary in different cases, but it always occupies an area which might be covered *in utero* by the child's fist or forearm when the elbow was flexed. It is interesting in this connection to note that in about one in seven of the reported cases, there was also some deformity of the hand or forearm of the affected side. This almost always takes the form of dwarfing of the hand and fingers with webbing of the latter.

The *pathology* of congenital pectoral defect is obscure. The lesions correspond to nothing found in the normal course of development, nor can they be attributed to any central lesion of the nervous system. It seems almost certain that, like those of congenital elevation of the scapula, they must have origin-

[1] Thomson, *Teratologia*, *Quarterly Journal of Antenatal Pathology*, Edin., Jan. 1895, 1.

ated from some local intrauterine pressure of an unknown nature.

The *diagnosis* presents no difficulty to those who are acquainted with the condition. I have, however, known the defect put down to an old pleural attack, or to an injury. Sometimes a defect of the lower portion of the pectoral muscles is seen in pseudohypertrophic paralysis, but in that disease it is always bilateral, the posterior axillary wall is affected as

FIG. 188.—Congenital Pectoral Defect, with absence of nipple on left side.

well as the anterior, and the subcutaneous tissue is not diminished in amount. Congenital elevation of the scapula (p. 728) is sometimes found along with this defect.

The *prognosis* as to usefulness of the arm on the side affected is good, provided the hand is normal. The defect of the pectorals interferes very little with the patient's capacity for ordinary work. No treatment is indicated.

Congenital Diaphragmatic Hernia.[1]

Hernia into the thoracic cavity, through a congenital defect in the diaphragm, of the stomach, colon, or small intestine,

[1] E. B. Leech and C. H. S. Redmond, *Med. Chronicle*, Apr. 1909, l., 1.

sometimes along with other organs such as the spleen, liver, and pancreas, is occasionally met with, and gives rise to symptoms which are very perplexing if the possibility of its occurrence is not remembered. The gap in the diaphragm is generally of considerable size and occurs much more frequently on the left than on the right side.

Symptoms.—There may be an entire absence of symptoms, at first; but, sooner or later, sometimes not for years, periods of more or less distinct interference with the respiration and circulation occur. Often, also, there are physical signs of a kind which cannot be explained by any other condition. We may, for example, have dyspnœa which varies greatly from time to time, with deficient expansion of the lower parts of the chest, or displacement of the heart with cyanosis. The affected side of the thorax moves less than the other, and shows an absence of breath-sounds; and it sometimes gives a tympanitic, at others a dull note, according to the organs involved in the hernia at the time of examination. A short time after a severe attack of dyspnœa, the patient is quite comfortable and little or nothing amiss may be found on physical examination. If the bowel becomes compressed, however, vomiting and other indications of intestinal obstruction generally occur.

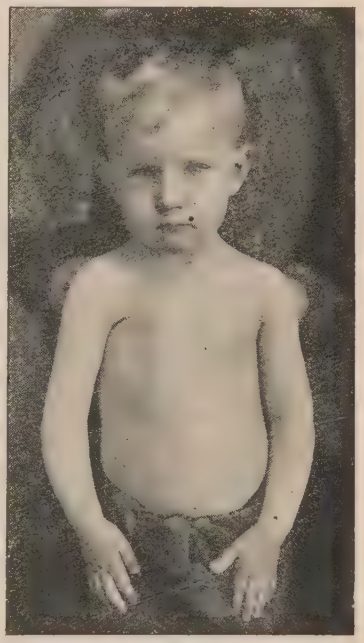


FIG. 189.—Congenital Defect of Pectoral Muscles and Chest Wall. Boy of 5 years.

In older children, if the hernia is not a large one, there may only be dyspnœa, a feeling of fullness, and cyanosis, after meals; and these patients may live a long time with comparatively little discomfort. If the opening is large, however, there are always, at times, more or less urgent attacks of embarrassment of the circulation and respiration, and intestinal strangulation may take place.

Diagnosis.—Although a precise diagnosis of the condition may not be possible at first, diaphragmatic hernia should always be suspected whenever symptoms such as those described above occur with greatly varying intensity, especially in young infants.

Treatment.—When acute strangulation takes place, an operation should be attempted for its relief; but, under other circumstances, surgical proceedings are inadvisable.

Congenital Defect of the Abdominal Muscles.

Congenital defect of the abdominal muscles is a very rare but extremely interesting abnormality both from a clinical and pathological point of view.[1]

Clinical Features and Morbid Anatomy.—All the cases reported have occurred in boys. About half of the patients died when only a few months old, any respiratory disease being rapidly fatal. One of them reported by Osler[2] was living at six, and another (Stumme[3]) at seventeen years. In Osler's case there was frequent micturition and slight polyuria; in none of the others were there any urinary symptoms.

The thorax is fairly normal in shape at the time of birth; but, when respiration begins, a pigeon-breast rapidly develops owing to there being no abdominal muscles to moor the lower margin of the chest-wall to the pelvis. The deep furrowing of the flaccid abdominal wall is very striking (Figs. 190 and 191). On section it is found that the only muscular tissue left consists of portions of the oblique and transversalis muscles, just below the costal margin and at the upper part of the abdomen behind; but over most of the abdominal surface there is nothing left but skin and fatty tissue. The aponeuroses are also absent. There is no defect of any of the muscles except those of the abdominal wall.

The bladder is much enlarged—about the size of a hen's egg—and its muscular wall is greatly thickened (Fig. 192), but no obstruction to the outflow of urine is present. The

[1] A description of a typical case of this abnormality, with an account of the literature of the subject, will be found in a paper by Lewis Thatcher in the *Edin. Med. Journ.*, Aug. 1913, N.S., xi., 127.

[2] *Johns Hopkins Hosp. Bull.*, 1901, xii., 331.

[3] *Mitth. a. d. Grenzgeb. d. Med. u. Chir.*, 1903, xi., 548.

FIG. 190.—During life.

FIG. 191.—After death.

FIG. 192.—Post-mortem appearances.

urachus is very short. Both ureters are dilated and tortuous, so that they look like pieces of bowel (Fig. 192). There is a moderate degree of hydronephrosis. The testicles are situated high up in the abdominal cavity.

Causation.—The best explanation of the origin of the defect is that given by Stumme. According to his theory the muscles have been prevented developing, during intrauterine life, by the prolonged pressure exerted outwards on the abdominal wall by an enormous distension of the bladder. This takes place during an early period of pregnancy. Long before the child is born, the bladder has become greatly hypertrophied and the organ has contracted so as no longer to press on the abdominal wall. The clinical appearances and the facts of the morbid anatomy seem to support this hypothesis. The wrinkled state of the surface of the abdomen is in keeping with the idea that it has been much over-distended; and the portions of the abdominal wall which are found still to contain muscular tissue are so situated that even an enormously distended bladder could not have exerted much pressure upon them. The explanation of the distension and thickening of the bladder wall is probably the same as in other cases of congenital hypertrophy of the organ (p. 364).

Myositis Ossificans.[1]

Progressive multiple myositis ossificans is a rare disease of childhood in the course of which portions of many of the muscles undergo a bony transformation. The muscles which are chiefly affected are those of the scalp, neck, trunk, and limbs, and the masseters; while the disease leaves unaffected those of the hands and feet, the muscles of expression, the external eye-muscles, those of the ear, the diaphragm, the muscles of the pelvis and genital organs, the sphincters, and all the unstriped muscles. The disease comes on in short attacks which usually run their course in from two to six weeks, but in the later stages of the malady the free intervals may last for months or even for years. The first appearance of the muscular affection often begins in infancy (in several

[1] Lydia M. De Witt, *Amer. Journ. Med. Sci.*, Sept. 1900, cxx., 294; H. D. Rolleston, *Clin. Journ.*, 23rd Jan. 1901, xvii., 209; A. E. Garrod, *St Bart. Hosp. Rep.*, 1907, xliii., 43.

reported cases at five months old), though it may not appear till later childhood. The part first attacked is generally the scalp or neck, or it may be one of the back muscles; later other parts of the back, the loins, the axillary folds, and the muscles of the upper arms and thighs are chiefly involved.

Spontaneously, or possibly after some slight injury, a well-

FIG. 193.—Myositis Ossificans. Girl of 3 years.

defined rounded or oval swelling appears over some portion of muscle (Fig. 193). It is doughy and elastic to the touch, sometimes slightly œdematous, and there is little or no tenderness. The skin and subcutaneous tissue seem to be involved to some extent as well as the muscle. There may, or may not, be a slight rise of temperature. After the swelling has gone on increasing in size for some days, it gradually diminishes; and, as it is subsiding, a small angular mass of bony hardness is generally felt. When this occurs it usually remains per-

manently, and it increases in size every time the same part is affected. Some of the swellings, especially in young children, subside without leaving any palpable hardness behind them. During the attack, as well as in the intervals, the child seems otherwise quite well. The distribution of the swellings is generally, although not always, asymmetrical. There are no sensory changes except slight tenderness; and the intellect is never affected.

FIG. 194.—Myositis Ossificans. Girl of 3 years. Deformity of thumbs and great toes.

As the disease progresses, walking becomes difficult, but for a long time the disease interferes curiously little with the child's movements, so that his school attendance is scarcely interfered with. The spread of the disease in the muscles of the neck, chest, and back, however, gradually weakens the power of the respiration, so that any chest-affection is apt to be dangerous. Another very serious matter is the involvement of the masseters, which may occur in the later stages of the disease and seriously interfere with the child's feeding by preventing opening of the mouth. The disease often becomes more active about the time of puberty. In no recorded case has the progress of the disease been permanently arrested.

It is a peculiar and most interesting fact that about three-quarters of the cases show, from birth, a peculiar form of *microdactyly* of the thumbs and great toes (Fig. 194), which seems to be pathognomonic, and proves that, although the muscular lesion is not present at birth, the tendency to it is congenital. The thumbs are small and short, usually with

an apparent partial ankylosis of their joints which are limited in their movements. The great toes are dwarfed and slope outwards (hallux valgus), so that the feet look like those of a woman who has been wearing short and pointed boots. Their joints may also be defective like those of the thumbs. In some cases, exostoses form on the digits, on the cranium, or elsewhere.

The cause of the disease is absolutely unknown, and no instance of its hereditary or family occurrence has been reported. It is about three times as common in boys as in girls.

No treatment has proved of any use. Iodides and thyroid have been tried without effect. It is well to encourage the child to use his muscles freely, short of fatigue.

Two other even rarer forms of chronic progressive generalised inflammation of muscles have been described by F. E. Batten[1] as myositis fibrosa and dermato-myositis.

In **Myositis Fibrosa** the muscles undergo a fibrous change, without bony transformation. The disease, which begins in infancy, is characterised by great debility and by a generalised flexion with rigidity of the neck, back, and limbs. It is usually slowly progressive, but some cases of gradual recovery have been recorded.

Dermato-myositis is a chronic inflammatory condition of the skin, subcutaneous tissue, and muscles which generally begins acutely with redness and swelling of the superficial parts and tenderness of the muscles. As the cutaneous swelling subsides, the muscles are left hard and infiltrated for some time. Successive attacks occur, and leave the skin thickened and inelastic, and the muscles fibrous and hard. Complete recovery may take place after months of illness, or the disease may progress to a fatal issue. The treatment consists in rest in bed and the administration of salicylates and antipyrine. Hot baths, massage, passive movements, and suitable splints are also useful in the later stages of the disease.

Myasthenia Gravis.

Myasthenia gravis is a very rare disease in childhood. I have only seen one case of it, a girl of eleven and a half years, a patient of Dr Lumsden of Denny. This child showed in a

[1] *Clin. Soc. Trans.*, 1904, xxxvii., 12 ; and *Proc. Roy. Soc. Med.*, Neurol. Sect., 1912, v., 103.

most striking way the readily produced and exaggerated signs of muscular fatigue which are characteristic of this interesting and obscure disease. She complained of a feeling of extreme tiredness on walking and inability to go upstairs. This had begun four months before I saw her, and was at first attributed to stiffness from rheumatism, though there was no pain. Soon after, it was noticed that towards afternoon her face lost all expression and the eyelids drooped. During sleep the mouth opened owing to falling down of the lower lip. The neck muscles were early affected, and soon became so weak that she had to give up doing anything that required her head being held forward. Lordosis also developed and the weakness gradually spread to the other muscles of the body, though they showed no apparent wasting. When walking, she often fell down "because she felt quite done." Her hands remained fairly strong, though she could only raise her hands above her head with difficulty by swinging them up, and could not keep them so for more than a few seconds. Similarly, she could not place her foot on a chair except by swinging the limb up from the hip, and when it rested on the chair she could not move it at all. When laid on the floor, the child had great difficulty in rising, and her attempts to do so resembled somewhat those of a patient with pseudohypertrophic paralysis. The speech was scanty, indistinct, and lisping, but not nasal, and speaking seemed to tire her. Three weeks before her death, which took place five and a half months after I saw her, the muscles of mastication became so easily tired that she had to stop her meals long before she was satisfied; and, during the last week of life, respiration was distressingly difficult. Sensation was not affected at any time, the knee-jerks and other reflexes were normal; the muscular sense and power of co-ordination were unaffected and there were no fibrillary twitchings.

One of the most striking features of the disease was the great variation at different times in the degree of debility. Until near the end, the child could get out of bed easily in the morning without assistance, hold herself erect, and walk fairly well; her face also looked fairly normal. Later in the day the eyelids drooped, the face lost its expression, and she walked and did everything else with increasing difficulty. Before evening she had to be lifted into bed. The thymus is said to be enlarged in 90 per cent. of the cases.

No treatment had any effect on the symptoms, but it is said that cases have sometimes recovered.

Muscular Dystrophy (*The Myopathies*).

The term "Muscular Dystrophy" is used to include a number of clinical types which have in common a progressive weakness, associated with changes in the affected muscles without any lesion of the spinal cord. The paralysis is unaccompanied by pain or any other sensory abnormality; and the affected muscles, unlike those in spinal paralyses, show neither fibrillary twitchings nor the reaction of degeneration. Their reaction to both galvanism and faradism is simply diminished. The knee-jerks and other deep reflexes are abolished, if the muscles concerned are affected by the disease. The mental condition is either normal or slightly impaired. The changes in the affected muscles consist in atrophy and pseudohypertrophy, and in a few instances there is temporary true hypertrophy.

The causes of muscular dystrophy are entirely unknown, but the disease is frequently seen in more than one member of a family, and the tendency may be transmitted to the next generation by the unaffected female members.

Some of the clinical types are fairly well defined and present curious and interesting differences, but transitional cases are not very uncommon. Which of the clinical varieties of myopathy are merely different phases of the same morbid condition, and which, if any, represent a different disease is an extremely difficult question which need not be considered here.

Pseudohypertrophic Paralysis.—Much the commonest and most striking of the myopathies met with in childhood is the pseudohypertrophic type. The patient, who is practically always a boy, is born in apparently perfect health, and only shows definite evidence of the disease when he is about five years old or within a year or two of that age. In some instances, he has seemed quite well and strong up till this time, but in others a history is given of his having been unaccountably late in walking, or of having always had difficulty in mounting stairs. As the disease progresses, the child's parents notice that he is getting weaker on his legs and is tired after the slightest exertion; also that he is easily knocked over and slow

in rising. On examination, some of the muscles, especially those of the calf, the glutei, and the infraspinati, are found to be abnormally large (Fig. 195); others such as the thigh muscles, the lower part of the pectoralis major, the biceps, and the latissimus dorsi, are diminished in size; while others again, like those of the face, neck, forearms, and hands, seem unaffected. In advanced cases, there is usually some pointing of the feet. The child's attitude in standing is peculiar. He holds his head up and his shoulders squared, while his back shows a marked lordosis He plants his feet widely apart and has a waddling gait. The late Professor Sanders used to sum up these points by saying "he straddles when he stands, he waddles when he walks, he falls and he can't rise."

FIG. 195.—Pseudohypertrophic Paralysis.

The way the child raises himself from the ground is particularly characteristic. He begins by straightening himself out and rolling round on his face, then he draws up the thighs, gets slowly on to all-fours, and laboriously struggles into the erect posture. In doing so, after getting on to his feet, he transfers his hands to the front of his thighs and raises his shoulders gradually into the erect position by "climbing up the thighs." Finally the head and shoulders are jerked backward, so as to bring them behind the centre of gravity of the body, thus restoring the lordosis which is necessary for its balance. This way of rising from the ground, though characteristic of this disease, is not altogether peculiar to it. It is seen also to a less degree in various other forms of

weakness of the lower limbs, such as rickety pseudoparalysis and early spinal caries.

The extreme weakness of the muscles of the shoulder-girdle gives rise to another striking symptom. This is demonstrated by trying to lift the child by means of a hand placed in each axilla. When this is done, the limp axillary muscles fail entirely to support the weight of the body which slips down through the hands, while the shoulders are carried up till they are on a level with the ears.

As years pass, the muscular weakness increases in degree and extent; but often its increase is intermittent, and it may be arrested sometimes for months or even years. By the time the patient is fifteen or seventeen years old, he is in a state of profound weakness and probably more or less bed-ridden. Death usually occurs rapidly from some respiratory complication.

Treatment.—Although no special form of treatment that cures the disease has been discovered, the progress of the paralysis can probably be delayed by massage, and especially by encouraging the moderate but persistent use of all the muscles, and not allowing the patient to be too long in bed. It is also important to keep up the general health by attention to the diet and digestion. Occasionally tenotomy may be necessary to make walking easier.

The Facio-Scapulo-Humeral Type (Landouzy-Dejerine) is characterised by weakness of the orbiculares oris and palpebrarum. This may be present at birth so that the baby cannot suck properly and is unable to close his eyes in sleep, and it usually remains stationary, or nearly so, for life. There is also weakness and wasting of the muscles of the shoulder-girdle, pelvis, thighs, and upper arms. These may become affected during childhood, but often are not so until well on into adult life. The disease affects both sexes equally, and is hereditary and familial.

The Juvenile or Scapulo-Humeral Type is much the rarest form of myopathy in childhood. Apart from the face not being affected, it resembles the Landouzy-Dejerine type in its distribution and in most of its other characters. The affection of the shoulder-girdle, which is its earliest manifestation, may begin as early as the sixth or seventh year. The progress of the disease is very slow and it does not endanger life

Amyotonia Congenita (*Myatonia Congenita, Oppenheim's Disease*).[1]

It has been usual to describe amyotonia congenita separately from the other myopathies, as its clinical features are somewhat different. This is done here to contrast it with myotonia, though Batten has shown[2] that there are many reasons for grouping it along with the others.

The diagnosis of Oppenheim's disease depends chiefly on three points—the symmetrical atrophy and flaccidity of the muscles (Fig. 196), their extreme weakness without actual

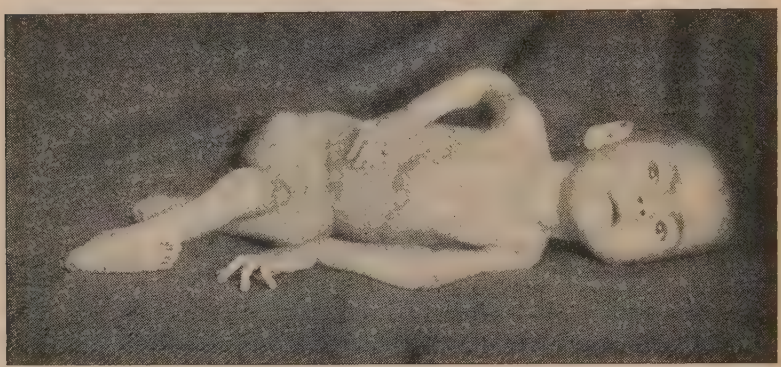


FIG. 196.—Amyotonia Congenita. Boy of 11 months.

paralysis, and the loss of the deep reflexes. In most instances these symptoms have been present from birth, though in some they have developed later, more or less suddenly, after an acute illness. There is generally found to be a tendency to slow improvement, although no case has as yet been reported in which recovery has taken place. The weakness and wasting are most striking in the limbs and less so in the muscles of the trunk, while those of the face are little if at all affected. The muscles react well to galvanism but, although strong faradic currents can be borne without inconvenience, the reaction to them is lowered. The deep reflexes are completely absent, but the superficial are normal. The sensibility seems unaffected. The mental condition is normal. The internal

[1] J. Collier and S. A. K. Wilson, *Brain*, 1908, xxxi., 1.
[2] *Quart. Journ. of Med.*, 1910, iii., 313.

organs are healthy, but the thorax is apt to become deformed as a result of the muscular debility. Most of the patients die in infancy from intercurrent respiratory disease. There seems to be no tendency for more than one case of the disease to occur in the same family. Its cause is quite unknown. I have seen one severe and typical case, and several slighter ones in mongols.

Treatment.—The treatment consists in regular massage, passive movements when contractures threaten, and the encouragement of active movements of all kinds. Faradism and galvanism are also to be recommended, as in this condition they do not apparently cause pain as in normal children.

FIG. 197.—Myotonia Congenita. Boy of 6 years.

Myotonia Congenita
(*Thomsen's Disease*).

When myotonia congenita begins in early childhood, it leads to a striking over-development of all the muscles. The hypertrophy may indeed be so noticeable that the child looks as if he had pseudohypertrophic paralysis. On closer examination, however, the mistake is easily avoided, for the muscles of the arms and hands and those of the neck and trunk are quite as much enlarged as those of the legs (Fig. 197); and their strength is increased as well as their size. Other signs of pseudohypertrophic paralysis, such as loss of the knee-jerks, are also lacking.

The first thing that the mother notices in a case of this disease will probably be that, after closing his eyes tightly during a fit of sneezing, the baby takes an extraordinary time and much effort to get them open again. This symptom is

easily demonstrated in an older child if you tell him to shut his eyes firmly and then to open them at once. To do so takes him several seconds and much grimacing before he can get them open (Figs. 198 to 202[1]). When he repeats the process,

FIG. 198.—Eyes closed.

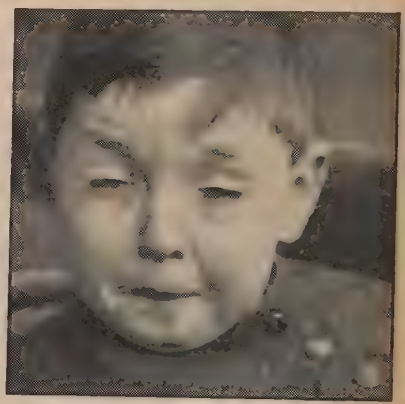


FIG. 199.—Trying to open eyes.

FIG. 200.—Eyes beginning to open.

FIG. 201.—Eyes open at last.

MYOTONIA CONGENITA.

however, it becomes much easier each time; and after doing it four or five times running, he can open his eyes quickly and normally.

As the child grows older, it is found that though he walks steadily and uses his hands as well as other children if he

[1] J. Thomson, *Edin. Med. Journ.*, March 1916, 216.

is allowed to take his own time, his limbs are curiously useless when he tries to do anything in a hurry. He cannot start running as quickly as other children; but, though his limbs seem very stiff and helpless when he begins to move, he gains control over them after a few steps, and can then run as well as other boys. A similar difficulty in beginning to move is seen in grasping and in all other voluntary movements, and it passes off quickly when the actions are repeated several times. All the other functions of the body are normal and the intellect is usually unaffected.

The disease, which is a very rare one, is not affected by any form of treatment; but, as the patient grows older, he learns in time how to minimise the inconvenience of his infirmity and to prepare by preliminary movements for expected exertions.

Sterno-mastoid Tumour (*Hæmatoma of the Sterno-mastoid*).

In the out-patient departments of Children's Hospitals, it is not very uncommon to see babies who are brought in the early weeks or months of life on account of a hard, painless, movable tumour in the substance of one or other sterno-mastoid. The swelling varies in size, being in some cases like a hazel-nut and in others as large as a pigeon's egg. It is generally situated about the middle of the muscle, and is much commoner on the right than on the left side. The mother has usually found the lump by chance while washing the baby, but sometimes her attention has been drawn to it because she has noticed that the head was being held inclined to the affected side. The tumour may be found as early as the first week, but often it does not attract attention until the child is from four to six months old or later. When discovered early, there is probably a definite hæmatoma present and the swelling is rather soft and sometimes fluctuates; later, however, it has a hard fibrous consistence.

It is now generally held that the sterno-mastoid tumour arises from tearing of the muscle during delivery. In a few of the cases, no history of a difficult labour can be obtained, but in a very considerable majority of them we are told that there has been either a cross-birth or a breech-presentation with difficulty in the delivery of the head; and, in those in which the head has presented, that a good deal of forcible traction

was necessary to get the shoulders to engage. Whether there has been a hæmatoma at first, or whether, as more frequently happens, there has been no sign of this, extensive chronic myositis always develops and often goes on until a hard tumour is formed by the secondary growth of dense fibrous tissue—a sort of "muscle-callus." The localisation of the fibrous swelling into an oval mass, and the comparatively slight separation of the torn ends of the muscle, are due to the complete sheathing of the sterno-mastoid by its fascia. In some of the cases there are other indications of the force which has had to be used at the time of delivery, such as cephalhæmatomata, Erb's paralysis of the arm, or separation of the upper epiphysis of the humerus.

Beyond simple measures for keeping the head still in the early stages and not allowing it to be bent over to the affected side, no special treatment is called for. Strong massage would probably increase the fibrous tissue formation, but gentle rubbing may possibly be of service. In time the tumour lessens, and it disappears entirely within a few months or at most within the first year of life; in a majority of the cases no bad effects are left.

The chief importance of the lesion depends on the fact that in a fair proportion of the cases—certainly in more than a third, and probably in most of those in which the muscle has been extensively torn—shortening results and a condition of wryneck develops which necessitates subsequent operation. In most, if not in all, of the cases there is also some degree of arrested development of the face on the affected side. This may not appear distinctly for a year or two, but I have seen it quite obvious within the first twelve months.

The causation of this facial hemiatrophy has given rise to much discussion, and it cannot be said to have been as yet satisfactorily explained. Some authorities accept Petersen's explanation.[1] He regards both the wryneck and the facial condition as parts of a primary developmental abnormality which has existed before birth, and believes that the giving way of the sterno-mastoid is always secondary; and that the muscle tears because it is short and tense, and not on account of any unusual force having been used at birth.

[1] *Zeitschr. f. Orthopädisch. Chir.*, i., l., 1, 113; *Centralbl. f. Gynäkol.*, 1896, No. 48.

A consideration of the clinical history of the cases, especially the extreme frequency with which they follow very severe labours, makes it difficult to accept this hypothesis; and it seems much more probable that the facial hemiatrophy and the wryneck are both the result of the injury. How the birth injury can affect the growth of the face is still hard to explain, but it has been suggested that it may arise in some way from an interference with the blood-supply.

Whenever it is found that the muscle is becoming shortened, the advisability of a surgical operation should be considered. This consists in cutting down on the muscle, preferably near its sternal end, and dividing freely not only the damaged sterno-mastoid but also any other structures which are interfering with the head assuming its normal position. There is no great hurry for this to be done, but it is probably advisable that it should be undertaken within a few months of definite contraction being noticed; and, unless the lesion is unusually extensive and severe, the result is generally most satisfactory.

Ischæmic Myositis (*Volkmann's Paralysis*).

When a limb has undergone prolonged excessive pressure from the unskilful application of a bandage during the treatment of a fracture or other injury, permanent paralysis and contraction of the muscles occasionally results. This, as Volkmann pointed out, is due to coagulation-necrosis of the muscular tissue from interference with the arterial blood-supply.[1]

Although the ischæmic myositis is the main and sometimes the only lesion present in these cases, there is occasionally an ischæmic neuritis also, involving the chief nerves of the affected limb. When this takes place severe pain, hypersensitiveness, or loss of sensation occurs, and the skin may become glossy or even ulcerate at the site of the pressure or on the hand or foot.

In the majority of cases, Volkmann's paralysis is found in the upper limb, and has occurred during the treatment of a fracture or other injury in the region of the elbow; but a

[1] W. Harris, *Brit. Med. Journ.*, 26th Sept. 1908, ii., 919; D. M. Greig, *Edin. Med. Journ.*, June 1910, N.S., iv., 498; Purves Stewart, *Brit. Med. Journ.*, 17th Aug. 1918, ii., 151.

similar condition occurs much less frequently in the leg during the treatment of fractures of the femur (Fig. 202).

Symptoms.—Soon after the too tight bandage is applied, the hand (or foot) becomes swollen and livid, and there may be severe pain. If the constriction is removed within a day or two, the circulation rapidly recovers; but, even by this time, permanent damage may have been done. At first, the muscles seem only paralysed, but very soon rigid contracture begins and it increases for several weeks. The muscles become very hard but do not waste much; they give the reaction of degeneration, and the deep reflexes are lost.

FIG. 202.—Ischæmic Myositis, after fracture of femur. Boy of 9 years. (Mr D. M. Greig's case.)

When the upper limb is affected, the wrist becomes firmly flexed and the fingers are bent into the palm. The thumb often escapes, because it has a long flexor of its own. In the lower limb the toes are flexed on the sole and the foot is pointed.

Prognosis.—When sensory symptoms are present, they may recover in time, but the injury to the muscles is beyond repair.

Treatment.—Some slight improvement may be hoped for from prolonged massage, hot baths, passive movements, and the use of suitable splints. When the lower limb is affected tenotomy is sometimes of service.

CHAPTER XXXIV

ON SOME DEFECTS AND DEFORMITIES OF THE BONES

Achondroplasia (*Chondrodystrophia Fœtalis*).

Pathology and Etiology.—Achondroplasia has been described as a morbid condition of the fœtus, in which there is "an absence, arrest, or perversion of the normal process of endochondral ossification, of the most definite and universal character, in every element of the skeleton in which the process normally takes place in intrauterine life."[1] Its effects are limited to those areas where bone is replacing cartilage. In it the normal pre-ossification process which leads to the so-called "organ-pipe" arrangement of the cartilage cells does not take place. The stimulus which brings about these changes in the normal state is unknown, "but such indications as are available point to a hormone, such as we may expect to arise either in the pituitary, thyroid, suprarenal, or genital glands, or by an interaction of the secretions of all these."[2] The interference with the ossification which is caused by this disease is believed to run its course between the third and sixth months of fœtal life. At birth, accordingly, we find mainly the results of a past disturbance, and not an advancing process as in congenital syphilis and cretinism.

The cause of this disturbance is absolutely unknown, but it has been observed to occur occasionally in several members of a family, or in a father or mother and child. In a few instances, cretinism, infantilism, or other forms of dwarfing have been found in the same family.

Clinical Features.—There are various degrees of severity of the disease. If the child is profoundly affected, hydramnios

[1] Symington and Alexis Thomson, *Lab. Rep. Roy. Coll. Phys. Edin.*, 1892, iv., 238.

[2] Arthur Keith, *Journ. Anat. and Physiol.*, 1913, xlvii., 189.

is often present, and the labour is generally premature. In such cases, if the baby is born alive, he is often so weakly that he dies within a few days. Occasionally, if he lives, hydrocephalus develops, or it may be present at birth. I have met with no other form of congenital defect in these cases except that, in one of my cases, there was congenital pyloric stenosis. From this the child recovered, under medical treatment, but he died later from hydrocephalus. When the child survives infancy, the subsequent development of his muscular, cutaneous, and reproductive systems is quite normal, and his intellect is unaffected. The chances of a long life are probably as good in these children as those in an ordinary individual—except in the case of women who become pregnant.

FIG. 203. — Achondroplasia. Still-born infant. (Dr H. Rainy's case.)

FIG. 204.—Achondroplasia. Girl of 4 years.

The most striking thing about the deformity produced by achondroplasia is the disproportion between the size of the trunk and that of the limbs (Figs. 203 to 205). The trunk

is of normal length, but rather narrow from the shortness of the ribs and the contraction of the pelvis. The arms and legs are much shortened, especially in their proximal segments. In adults they are often little more than half the normal length. The long bones are thick as well as short, with very broad epiphyses. They are also curved, the curves representing merely exaggerations of those normally present, and knock-knee is common. On X-ray examination, the ossification of the bones (*e.g.* of the carpus) in childhood is found to be very much retarded. The limbs are often surrounded by deep sulci, as if the skin and soft tissues were on an ampler scale than the length of the bones required. In Fig. 205 is shown

FIG. 205.—Statuette of the Egyptian God Ptah-Sokar.

one of the statuettes of the Egyptian God Ptah which are frequently found in mummy-cases. It shows the clinical characteristics of achondroplasia in a striking manner.

The hands are always peculiar.[1] They are relatively broad and very short (Fig. 206). The fingers are thick and short, and the individual digits often look all about the same length. The most striking peculiarity, however, is the want of parallelism in the fingers. When the hand is laid flat, so that the palm is not hollowed, they spread out in such a way that their ends are separate from one another, and not close together as in the normal hand. The index and middle fingers usually curve to the radial, the ring and little fingers to the ulnar side. For this condition the term "trident hand" has been proposed.[2]

[1] J. Thomson, *Edin. Med. Journ.*, June 1893, xxxviii., 1111.

[2] Pierre Marie, *Presse Médicale*, 14 juillet 1900, 21.

The shortness of the lower limbs gives the child a peculiar waddling gait; and soon after beginning to walk he develops a deep lordosis, which increases as he grows older.

The shape of the head is characteristic. It is rather above the normal size, the cranium being high and bulging in front and at the sides; and the root of the nose is distinctly depressed. The increased height and breadth are due to an overgrowth of the membranous elements of its roof and sides to compensate for the diminished size of the cartilage-formed bones of the base. In the full-time achondroplasic infant, the basi-occipital and the basi- and pre-sphenoid are fused into one mass, and the ossification in the pre-sphenoid is also arrested. The suture between the basi-occipital and the basi-sphenoid is closed, and those between the ex-occipital and the other components of the occipital bone are almost so; the foramen magnum is little more than one-half the normal size. The extreme shortness of the base which these changes produce gives rise to a contraction of the naso-pharyngeal space. They also contribute to the nasal retraction which is rendered more noticeable by the bulging of the forehead. At birth the tongue often protrudes from the mouth, but this is not a feature of the disease in later life.

FIG. 206. — Achondroplasia. Hand of boy of 5 months.

Diagnosis.—*At birth* the deformity described above forms a picture which is easily recognised. The appearance of these infants has often been described as "cretinoid," and aptly enough, because they are certainly like cretins in several particulars. The likeness, however, is to adult cretins, and not to cretin babies. In infancy, even severe cases of sporadic cretinism do not present much, if any, disproportion of the limbs and trunk, nor the typical physiognomy of the disease, except to a very slight degree (p. 421). The thyroid of the achondroplasic child is usually distinctly felt, and he does not develop supraclavicular swellings. On inquiry, also, it will generally be found that the child has cut his teeth early, and has not been late in beginning to walk; while rickety dwarfs have almost always been very backward in both these particulars.

The achondroplasic *adult* can be readily distinguished from the rickety dwarf by the symmetrical shortness of all his limbs, by the absence of rickety distortion in the spine, limbs, thorax, and head, and especially by the peculiar deformity of the hands.

Older achondroplasics differ from cretins in the normal temperature and texture of the skin, the muscular and intellectual vigour, and the natural development of the sexual characteristics.

Neither the administration of thyroid, nor any other treatment has any effect on the disease.

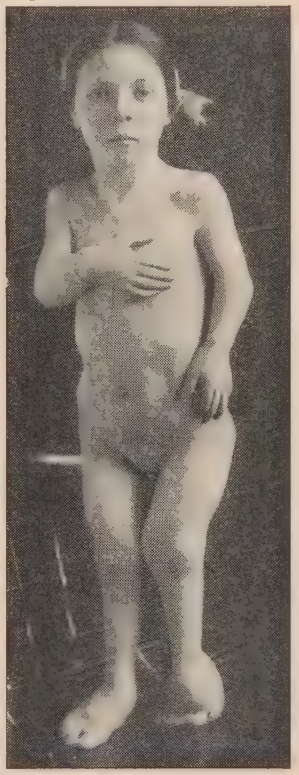


FIG. 207.—Short-limbed Dwarf. Girl of 9 years.

Other Forms of Dwarfing with Short Limbs.

There are at least two other varieties of dwarfing with short limbs and peculiar hands, which are apt to be mistaken for achondroplasia. They are both very uncommon, and in neither of them, so far as I know, has the pathology of the disease been investigated.

The most striking characteristics of the *first* of these (Fig. 207) may be described as follows:—

The deformity is present to its full extent at birth. The head is not obviously abnormal in its ossification, and has none of the usual achondroplasic characters. The auricles are sometimes peculiarly convoluted. The trunk and clavicles are normal in shape. The extremities, especially the upper arm and thigh, are shortened, and there is usually knock-knee after the child has walked for some time.

The hands are peculiar and characteristic. The fingers do not straighten completely, and their extremities deviate towards the mesial line of the limb, instead of turning distinctly outwards as in achondroplasia. In order, therefore, to make them lie parallel and in close contact with one another, the surface

of the palm has to be rendered convex. On X-ray examination, in the cases I have seen, the ossification of the carpal bones was found to be slightly in advance of the normal for the child's age. The feet are abnormally short, and show a tendency to talipes equino-varus.

The muscles are not abnormal, though poorly developed owing to the extent to which the abnormality of the feet has interfered with exercise. The intelligence is unaffected.

FIG. 208. — Short-limbed Dwarf. Boy of 10 years.

In one instance, the deformity occurred in twins; but no hereditary tendency to its occurrence has been observed.

The *second* of these types of dwarfs with abnormal hands is one, several cases of which were described by Herringham and Drysdale in 1908[1] (Figs. 208 and 209).

So far as can be gathered from these cases, and from four of mine, the main clinical features which characterise this disease, and which distinguish it from achondroplasia and other forms of dwarfing, are as follows:—

(*a*) The deformities of the bones are not congenital in origin, the size and conformation of the limbs being normal at birth and for many months after. The teeth come early and the fontanelle closes at about the usual time. During the latter part of the second, or in the third year of life, the child begins to suffer from rather severe pains in the lower limbs after walking, and very gradually the characteristic dwarfing of the hands and bowing of the legs develop. In one of my cases, early changes in the bones were recognised in the skiagram by the eighth month.

(*b*) The upper limbs continue to grow normally and there is no disproportion between the upper and fore arms. The deformity of the hands is the most striking feature. Their

[1] *Quart. Journ. Med.*, Jan. 1908, i., 193.

growth becomes gradually arrested within a year or so of the onset of the pains in the knees and, at the same time, they grow in thickness. The whole hand becomes stunted and much thickened, and the fingers are thick, fleshy, and conical, but they are quite parallel and show no deviation. On X-ray examination, great thickening of the phalanges is found, and their ossification, and that of the carpal bones, is seen to be very much delayed (Fig. 209).

Fig. 209.—Skiagram of Hand and Arm. Same case as Fig. 208, at 12 years.

(*c*) The lower limbs seem normal at birth, but from the time that the pains begin there is a tendency to bow-legs, and it gradually increases to a severe degree. The growth of the limbs is also somewhat arrested and they seem even shorter owing to the bowing.

(*d*) The head shows none of the characteristic peculiarities of achondroplasia, and the teeth are normal.

(*e*) The intellect and the sexual development are not interfered with.

(*f*) My three older cases suffered after the first year from well-marked rickety enlargements of the ends of the long bones and from beading of the ribs.

(*g*) Herringham and Drysdale describe three cases occurring in one family. My cases were father, son, and two daughters; no other relation was similarly affected.

Cleido-cranial Dysostosis.[1]

The rare hereditary and familial abnormality known as cleido-cranial dysostosis, first described by Sir Thomas Barlow in 1883, affects the bones which are normally formed in membrane, just as achondroplasia does those which originate in cartilage. It is very much rarer than the latter condition.

Clinical Features.—Its most characteristic features are (*a*) an exaggerated development of the transverse diameter of the

[1] T. Barlow, *Brit. Med. Journ.*, 15th Sept. 1883, ii., 509; Marie and Sainton, *Soc. méd. des Hôp.*, 1897 and 1898; Schorstein, *Lancet*, 1899, i., 10; Geo. Carpenter, *ibid.*, 13; D. C. L. Fitzwilliams, *Lancet*, 1910, ii., 1464.

skull; (*b*) delayed ossification of the cranium; and (*c*) more or less extensive aplasia of the clavicles.

The skull during infancy is largely membranous, and its ossification is late in taking place. The anterior fontanelle may close in later childhood, or may remain widely open during adult life. As the cranium ossifies, bosses form on the frontal, parietal, and occipital regions. The head is large, brachycephalic, and flat posteriorly, and its base is shortened. The face is relatively small, the palate high and occasionally cleft, and the teeth irregular. The eyes are rather staring, from prominence of the supraorbital regions compared with the lower borders of the orbits, the nasal bones are short, and the lower jaw sometimes underhung.

FIG. 210. — Cleido-cranial Dysostosis. (Sir Harold Stiles' case.)

The clavicles are defective. Sometimes one or other of them is altogether absent; generally, however, the sternal end is present, and often the central part only is wanting. Owing to the clavicular defect, the shoulders can be readily brought together so as to meet under the chin (Fig. 210).

The stature is rather short, and other defects of the osseous system, such as scoliosis, knock-knee, and club-foot, are sometimes present. Apart from the defect of the muscles which are connected with the deficient clavicles, the muscular and other systems of the body are normal. The intellect is unaffected, and the general health good. The condition is often hereditary. Treatment is, of course, out of the question.

Mollities Ossium.

Mollities ossium has been described as occurring rarely in childhood, though never apparently in early infancy. It affects both sexes, and may occur in more than one member in a family, but it is not hereditary.

The onset of the disease is gradual and there is pain in the limbs in the early stages. The whole skeleton is involved, but the effects of the disease are chiefly seen in the lower limbs. These show some bending of the bones, and occasionally fractures. There is great general debility, and the disease is difficult to distinguish from severe late rickets.

The patient has usually to be kept lying, and fresh air and the administration of cod-liver oil are indicated. Good results have been reported from the use of phosphorus and especially from adrenalin.

Fragilitas Ossium.

Brittleness of the bones, leading to their fracture from slight causes, is met with in some cases of infantile scurvy and congenital syphilis, and is not uncommon in severe rickets and in mollities ossium.

The term "fragilitas ossium" has, however, been usually employed in describing various rare congenital conditions, of which fragility of the bones forms a striking feature, but which have nothing to do with these other diseases. In a few of the cases, the abnormality only develops in later childhood; but in most of them it is congenital, and the tendency to fracture is present from infancy. Two groups of these seem to be fairly distinct clinical entities, and may be briefly described. These may be called "osteogenesis imperfecta" and "family fragilitas ossium with blue sclerotics."

Osteogenesis Imperfecta (*Osteopsathyrosis Infantilis*).

Osteogenesis imperfecta is the term most generally used at present to denote a rare intrauterine disease, the subjects of which are usually still-born, although they occasionally survive and live to adult life. Cases of the condition have often been described as instances of intrauterine or fœtal rickets, and sometimes they have been published as cases of achondroplasia. No cause of the disease has yet been discovered. I have known three cases to occur in the same family.

Pathology.—The bones are defective in calcification, and appear abnormally translucent on examination with the X-rays, and the periosteum is thickened. The disease depends on a

FIG. 211.—Girl of 2½ months.

FIG. 212.—Skiagram of lower limbs of the same child.

OSTEOGENESIS IMPERFECTA.

congenital disturbance of the periosteal formation of bone. There is no enlargement of the epiphyses and no beading of the ribs.

Symptoms.—When born, the children are fat and seem to be well nourished (Fig. 211). The cranial vault is very defective in its ossification, and shows large soft areas which remain membranous for many months. Generally there is at birth marked bending of many of the long bones (Fig. 212), often with fractures, of which there may be many. Some of these are evidently recent, and may have taken place during delivery, while others are of longer standing and are surrounded by callus. The trunk is dwarfed, but the limbs show little or no relative shortness, except that caused by the fractures and bending of the bones. In some cases there is an inability to straighten the elbows and certain of the fingers.

If the children survive, the fragility of the bones generally persists, and they are liable from time to time to fractures from slight causes. In a few undoubted cases there is only bending of the bones and no fractures, either before or after birth. The fractures usually recover without difficulty under ordinary treatment. In all the cases that I have watched for a number of years, the growth has proceeded slowly, and the stature has remained far short of the normal. As the patient reaches later childhood, there is a remarkable tendency for the twisted bones of the lower limbs to lose their curves and to become almost normal in shape.

The cranium is large for the size of the body, but in infancy its form is not specially characteristic. In many, if not in all, cases, a very peculiar type of cranial malformation develops. The skull is large and very broad with an angular projection running round its posterior and lateral aspects just above the level of the auricles (Figs. 213 and 214). There is a small upper and a relatively long lower jaw. The nose and chin tend to be long and pointed. In the cases I have seen there has been no blueness of the sclerotics, but this may occur in some cases.

The intellectual development of these children is normal and sometimes above the average. When they reach adult life, they often look more than their age. No medical treatment has proved of any value.

FIG. 213.—Side view. Boy of 11½ and girl of 8½ years.

FIG. 214.—Front view of same.

OSTEOGENESIS IMPERFECTA. Showing peculiar form of Cranium.

Family Fragilitas Ossium with Blue Sclerotics.

During recent years a great deal has been written on a type of fragility of the bones which occurs in many members of certain families, and is accompanied by a peculiar blueness of the sclerotics, laxity of ligaments, otosclerosis, and other symptoms. A full description of these cases, with a complete bibliography of the condition up to 1916, will be found in Dr Edith Bronson's very thorough paper on the subject.[1]

According to N. Voorhoeve,[2] the morbid phenomena present are due to a hereditary inferiority of the mesenchyme. This accounts for the implication of the skeleton, the articular ligaments, the sclerotics and, to a less extent, the circulatory system.

Clinical Features.—(*a*) *Brittle Bones.*—The children appear normal and well-formed at birth. They do not usually show any signs of rickets during infancy, and only very rarely do any fractures take place before the second or third year. Between that age and puberty, a number of fractures occur from moderately severe injuries. After puberty the brittleness of the bones diminishes, and fractures only rarely occur. It is very uncommon in this type to meet with such numerous fractures as are common in osteogenesis imperfecta. The bones show none of the ordinary characters of rickets, but present a rarified condition with a deficiency of lime salts.

(*b*) *Abnormal Laxity of the Ligaments.*—Some of the cases are described as "loose-jointed"; and a history of recurrent dislocations of the ankle, fingers, and other joints is not uncommon.

(*c*) *Peculiar Form of the Head.*—There is usually a characteristic shape of the head, which is recognisable in early childhood (Fig. 215). It is rather large, with a full forehead and prominent occipital and parietal regions. The shape differs from that in rickets and hydrocephalus, and shows no distinct bossing. This form of head is only seen in those members of the family who have a tendency to fractures.

(*d*) *Stunted Growth.*—The unaffected members of the families are generally of normal stature; but those who suffer from fragilitas ossium are usually several inches below the average.

[1] *Edin. Med. Journ.*, April 1917, N.S., xviii., 240.
[2] *Lancet*, 1918, ii., 741.

(*e*) *Blue Sclerotics.*—The incidence of blue sclerotics with brittleness of the bones was first pointed out in 1900 by Eddowes.[1] Their dark grey blue colour is usually quite distinct at birth. A similar or brighter blue colour of the scleræ is sometimes seen in non-familial types of fragilitas ossium, in congenital syphilis, and in some cases in which there is no special tendency for fractures to occur.

FIG. 215.—Family Fragilitas Ossium with Blue Sclerotics. Boys of 6 and 3 years. Showing form of head. (Dr Bronson's cases.)

The blue colour is apparently the result of undue transmission of the colour of the choroidal pigment through an abnormally translucent sclerotic. It has been suggested that the abnormal transparency may be caused by a lack of lime in the tissue of the sclerotic. In one of Dr Bronson's cases, the scleræ were found to be of normal thickness. The ocular tension is not abnormal. Those members of the affected families who have blue sclerotics seldom escape having fractures or dislocations sooner or later.

(*f*) *Otosclerosis.*—This disease, which is known to be

[1] *Brit. Med. Journ.*, 1900, ii., 222.

frequently associated with a variety of morbid conditions in the osseous and circulatory systems, has been found to occur in a considerable proportion of the affected members of these families who have reached adult life.[1]

(*g*) *Circulatory and Blood Diseases.*—In a small proportion of the published cases, hæmophilia has been present, and cardiac malformation has also rarely been noted.

Treatment.—No therapeutic measures seem to have any effect in preventing the tendency to fracture of the bones. Cod-liver oil and phosphorus have been often given for long periods without any good result.

Oxycephaly[2] (*Acrocephaly—Steeple-head*).

Oxycephaly is a rare developmental abnormality of the osseous system, with a curious malformation of the cranium as its most striking feature. As the commonest subjective symptom is impairment of vision, the condition has been mainly investigated by ophthalmic surgeons, and it was first described by von Graefe.[3] There is occasionally a hereditary history, and more than one case may occur in a family.

FIG. 216.—Oxycephaly. Girl of 10 months, who had recurrent dislocation of right eye. Syndactyly.

Clinical Features. — The characteristic appearances are readily recognisable at birth in the worst cases. In others they only develop slowly between the second and sixth year. The degree to which the shape of the head is altered varies greatly. In some instances, the deformity is so slight that it is only diagnosed on careful inspection and X-ray examination (Figs. 217 and 218), while in others it is very obvious (Figs. 216 and 219).

[1] W. S. Bryant, *Monatschr. f. Ohrenheilk.*, 1913, 436 and 584 (see Abstract by Dr J. S. Fraser in *Journ. Laryngol. Rhinol. and Otol.*, 10th Oct. 1915, xxx., 389).

[2] H. Morley Fletcher, *Quart. Journ. Med.*, 1910-11, iv., 385.

[3] *Arch. f. Ophthalm.*, 1866, xii., *Abth.* ii., 114.

FIG. 217.—Side face.

FIG. 218.—Front face.

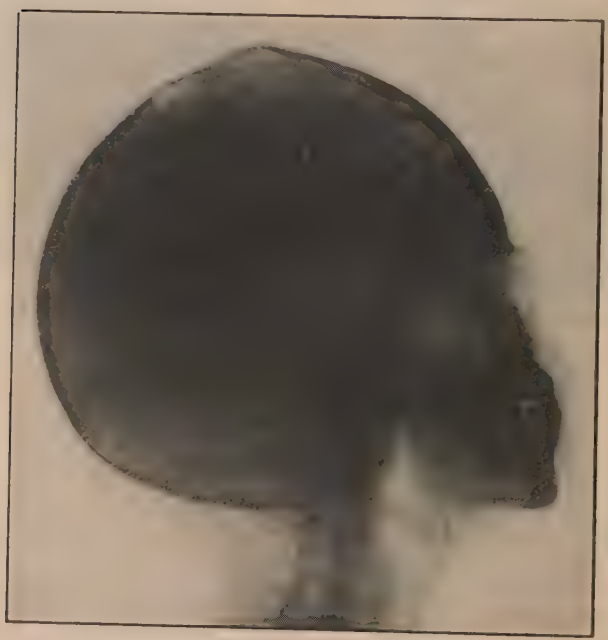


FIG. 219.—Skiagram of cranium.

OXYCEPHALY. Girl of 13 years.

The head is abnormally high and comes to a sharp point at the vertex. The superciliary and orbital ridges and the frontal eminences are feebly marked. The eyes are protuberant and slanting—the inner canthus being higher than the outer. In severe cases, the exophthalmos is so great that spontaneous dislocation of the eye outside the lids occurs from time to time on slight exertion. Divergent strabismus is common, and rarely a convergent squint forms. Nystagmus is present in many cases. Vision is occasionally unaffected; but, in a

FIGS. 220 and 221.—Oxycephaly. Girl of 12 years. (Dr R. Hutchison's case.)

majority of the cases, it becomes impaired sooner or later from the presence of optic atrophy—generally the post-neuritic variety. In the worst type of cases, there is often complete blindness. The hearing is good, and the taste is rarely affected but smell is often entirely lost. Severe headaches are a common symptom. The palate is abnormally high, and mouth-breathing is frequent.

Although the mental condition is unaffected or even above the normal in some of the slighter cases, most of the severer type show some mental defect. This, however, is rarely severe in degree.

In a large number of the worst cases, the hands are deformed, the fingers being webbed and badly developed. Occasionally there is some difficulty in full extension of the shoulder and elbow-joints.

The X-ray examination of the cranial bones is important, because it reveals an abnormality which is apparently pathognomonic of these cases. The bones present a pattern of rounded "digital" markings which look like impressions of the finger tips (Fig. 219).

On post-mortem examination of the skull, premature synostosis of the sutures is found, especially of the coronal and sagittal. The orbits are shallow and are directed downwards and outwards. The sella turcica is wide and its central portion deep.

The **diagnosis** is generally easy from the peculiarity of the deformity, and especially from the X-ray appearances. Cases are sometimes met with in which most of the characters of oxycephaly are present without pointing of the vertex.

Prognosis.—In the bad cases the children are generally feeble, but, in the slighter ones, the disease does not seem to shorten life.

The **causation** of oxycephaly is entirely unknown.

Treatment.—One can only treat the headache. This is said to be sometimes benefited by iodides. Trephining has given relief in some severe cases.

Multiple Exostoses (*Diaphysial Aclasis*).

Pathology. — The disease which gives rise to multiple exostoses has been shown by A. Keith[1] to be a disorder of growth analogous to achondroplasia, and not a form of tumour-growth as was formerly supposed. He suggests "Diaphysial Aclasis" as a suitable name for it.

As was recognised by John Hunter, the shafts of the bones grow in length by a double process. There is not only deposition of new bone in the cartilaginous growth disc at the end of the shaft, but also a "modelling process" by which the new bone there laid down "is pruned, reformed, and incorporated as an intrinsic architectural part of the cylindrical shaft."

[1] *Journ. of Anat.* (Cambridge), January and April 1920, liv., Parts ii. and iii., 101.

Multiple exostoses result from a disorder of growth in which the deposition of new bone goes on, while the modelling process is retarded and aberrant. Those bones which are formed entirely in cartilage—such as the tarsal and carpal bones, the epiphyses of all the long bones, the vertebral bodies and the sternum—are unaffected; and those formed in membrane only —such as the bones of the cranial vault and face—are also free from the disease. In the limbs, the exostoses occur only in connection with the growing ends of the shafts of the long bones, where a core of cartilage-formed bone is encased in a sheath of bone formed beneath the periosteum.

The disease is congenital in origin, but definite exostoses are rarely found in infancy or early childhood. The period during which they most often occur is between ten and twenty years, when the growth in the limbs is most active. After the twenty-fifth year, about which time the skeleton ceases to grow, no fresh exostoses appear; and, though those present remain, they may diminish appreciably in size in later life.

The **etiology** of the disease is quite obscure. According to Keith, there is reason to suspect that it may be due, in some way, to a disturbance of the function of one or more of the endocrine glands — possibly the thyroid. Certainly neither rickets, syphilis, nor rheumatism has anything to do with its occurrence. The condition is sometimes distinctly hereditary, and boys are affected about twice as often as girls.

Clinical Features.—The exostoses are in themselves painless, but they may cause distress from pressure on nerves at the time when they are growing rapidly. If they give rise to no serious inconvenience, they should generally be left alone. If, however, they are causing pain or tenderness, or producing deformity and interference with movement, as they are especially apt to do on the fingers, excellent results may often be obtained by their excision.

Congenital Defect of the Patellæ with Defect of the Nails.

The patella is not infrequently defective or absent in cases of severe club-foot and in some other deformities of the lower limbs.

A rare and interesting hereditary and family form of this

defect[1] is occasionally met with, in which a mother and several of her children have the patellæ either very small or quite absent, and along with this, an arrested development of the nails, which on both fingers and toes are small, ill-formed, and concave (Fig. 222). The patients are generally quite healthy and well formed in all other respects, except that a few of them are unable to straighten their elbows completely. In one family under my care, the mother and five children presented defective patellæ and nails, while the father and the other five children were quite normal in every way.

FIG. 222.—Congenital Defect of the Patellæ and Nails. Boy of 6 years.

These cases have a special interest and importance from the point of view of normal development, as they prove beyond all doubt, what does not seem ever to have been suggested by embryologists, that a close relationship exists between the development of the patellæ and that of the nails.

The absence of the patellæ does not appear to interfere in any way with the usefulness of the limbs.

Congenital Elevation of the Scapula (*Sprengel's Deformity*).

Congenital high scapula is a not very rare deformity in which one shoulder-blade is placed higher by an inch or two than the other. The affected bone is nearly always smaller than the other one, and is tilted round so that its angle is nearer the spine than it should be. The deformity results in some restriction of the movements at the shoulder joint, so that the arm cannot be raised to more than a right angle from the trunk. In about a half of the reported cases, there is some congenital scoliosis. In some cases the vertebral

[1] A. C. D. Firth, *Brit. Journ. Dis. Child.*, July 1912, ix., 305.

border of the affected scapula is connected with the spine of the 6th or 7th cervical or the 1st dorsal vertebra by a fibrous band or by a triangular plate of bone or cartilage (Fig. 223). In very rare instances, both sides are affected.[1]

In most of the cases no other defect is present; but,

FIG. 223.—Congenital Elevation of the Scapula, with bridge of bone uniting scapula and spine. Girl of 10½ years.

in a considerable minority, there are associated deformities. There may, for example, be a partial absence of several of the ribs in the neighbourhood of the shoulder-blade (Greig), or a congenital pectoral defect (p. 689), or a complete or partial deficiency of some other muscles, or of single vertebræ; and

[1] Willett and Walsham, *Lancet*, 1883, i., 453; Sprengel, *Arch. f. klin. Chirurg.*, 1891, xlii., 545; D. M. Greig, *Edin. Med. Journ.*, 1911, N.S., vi., 242.

quite a large number of other congenital defects have been described in a few cases.

Etiology.—The causation of the abnormality is still uncertain, but there can scarcely be any doubt that it is of the same nature as that of congenital unilateral pectoral defect, and that no theory is satisfactory that does not account for both conditions. A variety of theories have been advanced. That of Sprengel seems to be the most probable. According to this, the malformation is brought about by some kind of abnormal mechanical pressure on the shoulder during intrauterine life, along with prolonged fixation of the arm behind the back; and this pressure is supposed to be connected with a deficiency of the liquor amnii. In some instances there has been no lack of amniotic fluid at birth, but this does not prove that it may not have been scanty during an earlier stage of the pregnancy.

Treatment.—If there is a bony or other attachment of the scapula to the vertebræ considerable improvement may result from its removal. Otherwise there is no advantage to be gained from a surgical operation.

CHAPTER XXXV

ON RHEUMATISM AND LITHÆMIA

On Rheumatism in Childhood.

MANY of the older authorities on the diseases of children have written of rheumatism as a rare disease in early life. Owing largely to the work of Barlow, Cheadle, Lees, and Poynton,[1] it is now generally recognised that it is not only a common condition in childhood, but that its manifestations are more characteristic, more varied, and usually more serious in early than in later life. True rheumatism does not, indeed, ever occur in early infancy, being practically unknown during the first two years; but, from three or four onwards, it is increasingly frequent, and it is probably commoner about ten or twelve than at any other period of life. In about 60 or 70 per cent. of the cases, there is a family history of the disease.

Pathology and Etiology.—In spite of the strong family history of the disease in a majority of the cases, there are many reasons for regarding acute rheumatism as, in all probability, a micro-organismal disease; but the causal organism has not yet been finally determined. Some years ago it seemed as if it would prove to be the "diplococcus rheumaticus" of Poynton and Paine; but as yet complete confirmation of their results has not been forthcoming, so that the matter still remains unsettled.

Apparently, scarlet fever acts as a strong predisposing cause

[1] Barlow, *Brit. Med. Journ.*, 15th Sept. 1883, ii., 509; Cheadle, *The Rheumatic State in Childhood*, London, 1889; Lees, *Allchin's Manual of Medicine*, 1900, i., 291, and *Treatment of some Acute Visceral Inflammations, and other Papers*, London, 1904; Poynton and Paine, *Lancet*, 22nd and 29th Sept. 1900, ii., 861 and 932; and *Trans. Roy. Soc. Med.*, 1912, v., Path. Sect. 18.

of acute rheumatic attacks; and any form of infective catarrh may have a similar effect.

Symptoms.—The manifestations of rheumatism in children differ in an interesting way from those in older people. In adults, the characteristic clinical picture of an ordinary acute rheumatic attack is that of a very painful polyarthritis, associated with a considerable degree of fever, and with profuse acid perspiration, and liable to be accompanied by various complications, especially in connection with the heart. In children, in fully one-half of the cases, there is no joint affection at all; and, when any is present, it is often very slight indeed. There is generally little or no fever, and profuse perspiration is scarcely ever noticed. Other manifestations of the disease, however, are much more often met with in children than in adults. Subcutaneous nodules, chorea, and skin-affections are much commoner in childhood, and heart-lesions are especially frequent and severe.

Preliminary Symptoms.—In many cases the only symptoms noticed during the onset of a serious rheumatic attack in a child are *languor*, *pallor*, and *wasting*, although extensive changes in the heart may have already occurred. Not infrequently *epistaxis* takes place; and occasionally a *pain* in the epigastrium of doubtful origin is complained of.

Tonsillitis.—Sore throat is often an early symptom, and its presence should always suggest a careful examination of the heart. Rheumatic sore throats are indistinguishable, except by their complications, from other varieties of throat affection.

Arthritis. — The character and diagnosis of rheumatic arthritis have already been considered (p. 73). It is never safe to neglect the auscultation of the heart in a schoolboy with arthritis, even although there may be a distinct history of a football injury to the joint.

Muscular Rheumatism.—Muscular pains and contractions, especially in the neck, are among the less common manifestations of rheumatism. They are commoner as a symptom of lithæmia.

Cardiac Affections.—The heart is more frequently implicated by rheumatism in children than in adults, and indeed seldom escapes altogether, although often it is only affected temporarily and to a very slight degree. Its physical signs must always be carefully watched, as the prognosis of the case depends

largely on the extent and character of the cardiac lesion if any is present.

It is characteristic of childhood that the *myocardium* is very often the part chiefly affected. If the lesion is mild in degree, only a slight temporary dilatation may occur, with increase of the dullness to the left, accentuation of the pulmonary second sound, and some impurity of the first sound or a slight systolic murmur at the apex. If severe, serious and prolonged dilatation may result. A large proportion of the loud purely systolic mitral murmurs, which follow rheumatic attacks in children, recover in time completely and are due to this form of myocardial affection and not to valvular disease.

Endocarditis, usually of the mitral valve, is also common. It is probably entirely recovered from in some cases, but often leads to a degree of permanent valvular defect, with more or less compensatory hypertrophy. The aortic valve is sometimes, though much less frequently, affected; but, as basic hæmic murmurs are common in this disease, it is often difficult to be sure of its being implicated unless a diastolic murmur also is heard.

Pericarditis is generally one of the later manifestations of the disease, but sometimes occurs in a first attack. It is usually associated with dilatation of the heart and with a slight rise of temperature. Its onset is often insidious, and sometimes it is marked by vomiting. It is generally subacute in character and shows a tendency to recur. It is rarely associated with much effusion; and when fluid effusion appears it is not purulent.

Thrombosis is one of the rarer manifestations of the disease, and occurs mainly in the veins of the lower extremities.

Pleurisy is not often a rheumatic symptom, even when met with in rheumatic children; but occasionally it occurs as one of a series of rheumatic manifestations. Like rheumatic *pneumonia*, it is said to be more frequent on the left than on the right side.

The *digestive derangements* met with in rheumatism are furring of the tongue from gastric disturbance and vomiting, which may be due to the administration of salicylates, or may indicate the onset of cardiac dilatation or pericarditis.

Skin-eruptions of various kinds, especially erythema circina-

tum or multiforme, are often present during the onset of an acute attack, and urticaria sometimes occurs. Such rashes indicate an active state of the disease. Erythema nodosum is probably rare as a rheumatic manifestation, but it certainly may appear in typically rheumatic children. Purpura is met with in some severe cases which seem to be analogous to malignant cases of the exanthemata.

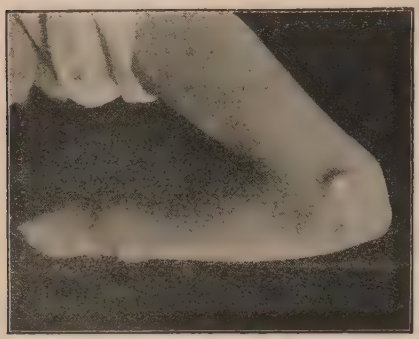


FIG. 224.—Rheumatic Nodules on Elbow.

Rheumatic nodules are an extremely important manifestation of the disease from a diagnostic point of view. When they occur in children, they not only indicate the presence of rheumatism, but show that the disease is present in a serious and progressive form, and that active anti-rheumatic treatment should at once be adopted. They are to be found in a considerable proportion of rheumatic attacks in children in this country, but are said to be less common on the Continent and in America.

The nodules vary from the size of a pin's head to that of a pea, or even larger (Figs. 224 to 227). Generally only a few are found at a time, usually over the bony prominences of the elbows, knees, or ankles, but occasionally they are present in large numbers, growing not only about all the bony prominences of the limbs, over the vertebral spines and under the scalp, but also on the ribs, clavicles, scapulæ, and iliac crests and over the prominent tendons of the extremities, and the fasciæ of the erector spinæ and abdominal muscles—even, rarely, on the rims of the ears (Fig. 226). They appear in crops, lasting usually a few weeks, sometimes several

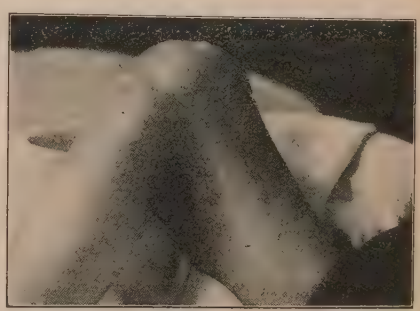


FIG. 225.—Rheumatic Nodules on Knee.

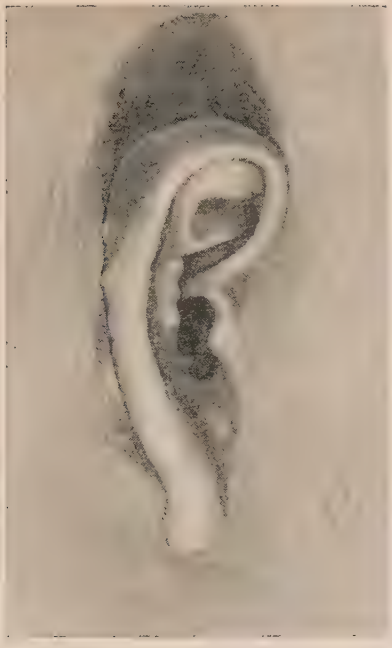


FIG. 226.—Rheumatic Nodules on Auricle.

FIG. 227.—Rheumatism and Chorea. Hair cut to show Nodules on Scalp.

months, and rarely more than a year. I have, in one instance, watched several nodules for more than eighteen months before they disappeared. When rheumatic nodules occur in adults they sometimes persist much longer; I have seen a case in a man over forty, in which large typical nodules had lasted for many years. The skin over the nodules is not reddened, and is not adherent to them. They are somewhat loosely attached to the periosteum or other fibrous membrane over which they lie. They are not at all painful or tender, except to a slight degree, when they are growing rapidly in tense structures, such as the scalp or palm, or have been irritated by pressure. When present, they are easily recognised, if carefully looked for; and if the skin is moved over them in a good light, they are even more easily made out by inspection than by palpation. Occasionally the nodules are present in very large numbers, as in the case represented in Figs. 226 and 227, in which more than two hundred were found on several occasions in different parts of the body.

The subcutaneous rheumatic nodule is said to be homologous with those which often form on the valves and pericardium in acute rheumatism, and are evidently the product of local rheumatic inflammation.[1]

Pyrexia is often absent in the acute rheumatism of childhood when the joints are unaffected; but slight rises of temperature for a few days at a time are common and may be very important. They may be caused by giving solid food too early, but they often indicate the beginning of an attack of endocarditis or pericarditis. *Hyperpyrexia*, which is such a grave symptom in adults, is almost unknown in the rheumatism of children; and Langwill[2] has pointed out that, in the extremely rare instances in which it has been reported, the other symptoms have always been markedly of the adult type.

Chorea is certainly to be regarded as a manifestation of rheumatism in a large proportion of the cases, although many are met with which seem to have nothing to do with this disease. It is, indeed, well to regard every choreic patient as probably rheumatic, and to be ready to treat him accordingly.

[1] Poynton and Still, "The Histology of the Rheumatic Nodule," *Trans. Path. Soc. Lond.*, 1899, l., 324.

[2] *Scot. Med. and Surg. Journ.*, Jan. 1899, 39.

An attack of chorea is not seldom the first of a series of rheumatic phenomena.

Habit-spasm is not a rheumatic symptom like chorea. It seems probable, however, that the general disturbance of the nervous system which the rheumatic poison produces, predisposes in some degree to this affection, as it does to other functional nervous disorders, such as enuresis, night-terrors, somnambulism, and lienteric diarrhœa; for the disease certainly seems rather commoner in rheumatic than in other children.

Diagnosis.—There is, at present, no certain way, during life, of recognising whether a given clinical phenomenon or case is rheumatic except by a consideration of all the clinical facts and especially of the age of the child, the nature of such other symptoms as are present, and the family history. The mere occurrence of so-called "rheumatic" pains is of no assistance in the diagnosis. If inflammation of one or more of the larger joints recovers rapidly on salicylate of soda, it may be regarded as rheumatic; and, if the pain is unaffected by the salicylate, it is certainly not of that nature, but probably due to gonorrhœa, tuberculosis, or some other cause. The apparently spontaneous onset of valvular disease in an older child, with or without fever, generally means rheumatism. Much the most important of the rheumatic manifestations, from the point of view of the diagnosis are the subcutaneous nodules; their presence is a practically certain proof of the rheumatic origin of the case.

Prognosis.—Except in the case of young children (three to five) with severe heart affection and nodules, or in those in whom both aortic and mitral valves are badly affected, the immediate prognosis of an attack of rheumatism is fairly good. In the older cases, the cardiac lesions generally recover to a surprising extent, if well cared for, and many hearts that seem damaged for life recover in time and become normal. Generally speaking, it may be said that the older the child is when the first attack occurs, the better is the prognosis as to ultimate freedom from rheumatic recurrences.

The *ultimate prognosis* as to the child's future health, and the chance of the disease recurring depend very largely on the amount of care that is taken of him. The difference between the after-histories of dispensary cases and those of better class children is very striking. Among the latter, many never have a second attack, while comparatively few of the poor children

who have once suffered from the disease escape without a series of more or less serious relapses.

The presence of subcutaneous nodules, especially if they are in large numbers, is a very bad omen for the child's future. In nearly all instances the nodules are accompanied by severe valvular disease. I have, however, seen one boy of six years with dozens of nodules and a systolic murmur during a first attack, who ten years later had had no recurrence of rheumatism in any form and whose heart was quite normal.

Treatment.—In our dealings with cases which present any of the phenomena of rheumatism, we have always to bear in mind that the illness depends primarily on the presence of a peculiar constitution, or diathesis, and that the treatment of this is even more important, and certainly much more difficult to have carried out, than the management of its temporary manifestations.

During the Attack.—When a child is recognised to be suffering from acute or subacute rheumatism, in any form, he should be clothed in flannel and put to bed between blankets, however slight his symptoms. If the bowels are not acting freely, a dose of castor oil or calomel should then be given. If there is any rise in temperature, the diet should be limited to milk; but, if not, some farinaceous food and eggs may be added. If arthritis is present, the affected joints should be wrapped in cotton-wool.

If the symptoms are of recent duration, or at all acute in character, salicylate of soda should be given at once, and usually in full doses. I generally order 10 grs. for a child of eight or ten, combined with twice as much bicarbonate of soda, and give it every two, three, or four hours, to begin with, according to the severity of the symptoms, diminishing the frequency of the dose as the symptoms improve. It should be well diluted, and given after food. The addition of the bicarbonate is of importance because, to a large extent, it prevents the occurrence of acetonæmia (p. 457), and, *provided the bowels are properly regulated*, any other ill effects from the salicylate. The effect of the drug should, however, be carefully watched; and, if deep gasping breathing, or any other sign of acid intoxication sets in, it must be stopped at once, and the amount of bicarbonate increased. Fortunately, this form of acetonæmia is very much less dangerous than most other varieties.

Although it is probably advisable to give salicylates or some similar drug to some extent in all cases of rheumatism, its action on certain of the rheumatic manifestations is disappointing. The effect on sore throat, joint pain, and pyrexia is obviously beneficial, but even large doses exert no apparent influence on the subcutaneous nodules or on the cardiac lesions. Its results in cases of chorea are discussed elsewhere (p. 592).

In children, the drug rarely if ever causes the deafness and other aural symptoms which occur in adults. It is, however, sometimes badly borne owing to its irritating effect on the stomach; and salicin, salol, and aspirin have therefore been recommended as substitutes. These may all be useful in some cases, but they have certain disadvantages. Salicin, to be effective, has to be given in twice the doses of the salicylate of soda; salol, in some children, sets up carboluria; and aspirin, though very efficacious in relieving pain and quieting restlessness, has the great drawback that it is incompatible with alkalies. Although the salicylate occasionally disagrees, it is usually well borne; and sometimes it agrees particularly well with rheumatic children, especially in subacute cases. I have not uncommonly seen marked improvement in appetite, renewed gain in weight, and increased feeling of well-being setting in shortly after it had been given.

When the heart is affected, even in the slightest degree, the child should be kept in bed for some weeks at least, and the anti-rheumatic treatment continued. When he is allowed to go about, he must still be carefully watched for several weeks longer before he resumes his ordinary habits. If the cardiac condition is severe, complete rest in bed for many weeks may constitute the most important part of the treatment. Although fresh air is very desirable, it is essential that, in obtaining it, the patient should not be exposed to draughts of cold or damp air as these are very injurious to him.

During convalescence, iron and other tonics, and cod-liver oil are indicated.

After the Attack.—A child who has once suffered from any form of rheumatism is always in danger of having some other manifestation of the disease. This danger can be greatly lessened by watchful care and prompt action on the part of his relatives. In the first place it is generally a good plan that he should, every month or so, to begin with, take

salicylate and bicarbonate of soda in small doses for a few days as a precaution.

The child should wear flannel next the skin and be warmly clad, and bare limbs, in this climate, must not be allowed. Unnecessary exposure to cold and damp are to be avoided, and especially sitting in wet clothes. Very few sweets should be given but, after the acute stage of the disease has passed, there is no reason to forbid an ordinary amount of meat.

The most important thing of all is that a sharp look-out should be kept on all slight ailments, and that they should be promptly treated. If the child is becoming anæmic or is otherwise out of sorts, he should at once see his medical attendant. If he has any muscular or joint pains, or rise of temperature, he must go to bed and have a course of rheumatic treatment. Any complaint of "growing pains" must be taken seriously. The occurrence of a sore throat must be regarded as the probable precursor of a rheumatic attack and treated accordingly.

As septic infections of all kinds are especially bad for rheumatic children, it is important that they should always have the throat, naso-pharynx, and nose carefully attended to and kept in as healthy a condition as possible. Aural discharges, bad teeth, and any forms of catarrh should also be carefully treated.

The details of the child's life, especially those of his school life and holidays, should be regulated by medical advice.

It is desirable that he should, if possible, live in a dry climate, and an inland place is generally better than the seaside.

On Lithæmia.

It is not necessary here to discuss the obscure subject of the pathology of the condition which is usually called "lithæmia." Its manifestations are very common in childhood, as might be expected from the part which heredity plays in its causation. They are numerous and varied,[1] and it is important to recognise their nature, as many of them respond rapidly to treatment.

Symptoms.—In infancy, children with lithæmic tendencies are often strong, firm, and active, and they may have a good

[1] See Dr Rachford's excellent article on "Lithæmia" in Starr's *Textbook of the Diseases of Children*, 2nd ed., 94; and Stoeltzner, *Oxypathie*, Berlin, 1911.

colour, although they are sometimes anæmic and weakly. Mentally, they are apt to be precocious and somewhat irritable. As they grow older, they generally become pale-faced and suffer from chronic intestinal dyspepsia. They are subject from time to time to a variety of ailments which have certain characteristics in common. These are that they tend to occur periodically, that they usually set in without any recent dietetic cause, and often alternate with one another.

Any system of the body may be affected. Urinary symptoms, for example, are common. In young babies renal colic, with the passage of large uric acid crystals, is sometimes met with, and other signs of irritation from abnormal urine are frequent. In older children, enuresis or recurrent functional albuminuria may occur. Acetonæmia attacks are not uncommon. In these we find nausea, vomiting, and gastric pains, which are not apparently due to errors in diet and which, once they have started, are little affected by medicine. They are sometimes accompanied by a high temperature and rapid respiration, and in severe cases they may be ushered in by a convulsion.

A common manifestation, and one the cause of which it is important to recognise, consists in *extreme irritability of temper*. The patient, who may be ordinarily a docile and sweet-tempered child, becomes unmanageable and extremely naughty. His attacks of passionate screaming may, indeed, be so severe as to be almost maniacal. Much unnecessary distress may be caused to the parents by such outbreaks, as they are apt to be attributed to sheer wickedness. The way in which they yield to medicinal and dietetic treatment is often striking and satisfactory.

Asthmatic symptoms of various degrees, and eczema, are common and often alternate with one another. Occasionally severe wry-neck and other forms of "muscular rheumatism" occur, and when, as not rarely happens, they are accompanied by functional heart-murmurs, the cases are often mistaken for real rheumatism.

Treatment.—Careful regulation of the diet is the first thing called for. Overeating is especially to be avoided, and such things as pastry and sweets must be forbidden. Meat soups and butcher meat are inadvisable, except in small quantities. The diet should consist mainly of milk and

cereals, and in older children fresh fruit and green vegetables are indicated. A moderate amount of eggs, fish, and white meat is allowable. It is important that the child should drink a considerable quantity of fluid (plain water, aerated water, etc.). Plenty of exercise in the open air must be arranged for, and sitting in close rooms is especially to be avoided. Possible causes of reflex irritation, such as phimosis, adenoids, and constipation, are to be sought for and treated.

Judicious drug treatment is very useful. To begin with, in acute manifestations of the condition, a dose of calomel is generally indicated. Thereafter a course of salol or salicylate with bicarbonate of soda should be commenced and continued for many weeks—sometimes for months. In babies, salol (1 gr.) may be given after each nursing, and in older children, salicylate of soda (3 to 4 grs.) three or four times a day between meals. Along with this, citrate of lithia (1 gr. thrice daily for an infant), or bicarbonate of soda (2 to 7 grs. according to age), or citrate of potash (3 to 10 grs.) should be given.

CHAPTER XXXVI

ON SYPHILIS (CONGENITAL AND ACQUIRED)

SYPHILIS in children may be *congenital*, that is to say it may arise from intrauterine infection; or it may be *acquired*, either during parturition, or at a later period of childhood. The clinical features of congenital and acquired syphilis are in most respects identical, but they differ in two particulars. The first of these is the extreme frequency of snuffles in the former, while, in the latter, it is almost unknown. The second is the striking difference in their infectivity. Acquired syphilis is actively contagious to other children; the congenital form of the disease rarely if ever spreads in this way.

Congenital Syphilis.[1]

Mode of Infection.—Experience with Wassermann's reaction has shown that the mother of a child with congenital syphilis is almost certainly always herself syphilitic. There is no proof that a father can infect the child *in utero* without infecting the mother also.

Neisser[2] has demonstrated, by experiments on animals, that the character of the symptoms which follow infection with syphilis depends to a large extent on the site of the inoculation. He found it difficult to convey the disease by subcutaneous injection; but, when he succeeded in doing so, the symptoms were those of a toxæmia. Probably, therefore, the fact of the mother's infection occurring through the uterus may explain the "latency" of the symptoms, which is observed in so many

[1] Henoch, *Lectures on Children's Diseases*, 4th Edit. New Sydenham Soc. Transl., 1889, vol. i., 92: J. A. Coutts, *Some Aspects of Infantile Syphilis*, London, 1897; Leonard Findlay, *Syphilis in Children*, London, 1919.

[2] *Beiträge z. Pathol u. Therapie der Syphilis*, Berlin.

cases and is so different from what occurs when the virus enters by the skin or vulva. It is probable that Colles' Law is to be explained on these lines. Exceptions to it are extremely rare, and they may be assumed to be examples of superfœtation —a second infection having taken place during the course of the first.[1] Many mothers who have shown no primary or secondary symptoms suffer later from tertiary manifestations.

It seems possible that the mother's first infection may sometimes be contracted from a child in her uterus who has received the disease from an infected father; but, in succeeding pregnancies, she will transmit syphilis to her children. The spirochæte has not yet been demonstrated in the semen, but apes have been infected by the seminal fluid of syphilitic men. Undoubted instances have been reported in which one twin was healthy and gave a negative Wassermann reaction, while the other showed typical evidence of congenital syphilis.

The transmission of syphilis to a third generation must be extremely rare, but we have it on the high authority of F. W. Mott that it does sometimes occur.

Infectivity.—The virulence of the infectiveness of the spirochæte seems to be usually—perhaps always—destroyed by its sojourn in the infant's tissues.

It has been a common experience in dispensary practice to see healthy children fondling and kissing babies with typical congenital syphilitic eruptions, discharges, and sores, which are now known to contain the organism in great abundance. Yet, even the most experienced physicians to Children's Hospitals seem never to have seen any well-authenticated cases in which this practice has led to infection. The few cases on record in which this seemed to have occurred were all possibly explicable in other ways. I have known of a number of healthy infants being vaccinated by mistake from a baby with congenital syphilis (in Vienna), and none of them took the disease. Coutts records a few instances in which adults were apparently infected from syphilitic babies, but it seems impossible to be quite sure that the syphilis might not have been acquired and not congenital. Until the question has been thoroughly investigated, however, it will be well to continue to take precautions.

[1] Rietschel, *Zeitsch. f. Kinderheilk.*, 1911, Ref. Bd., iii., 577.

Symptoms.

The clinical manifestations of congenital syphilis may be divided into three groups, according as they are (1) Early—beginning between birth and two years; (2) Intermediate—between the second and fifth or sixth year; or (3) Late—occurring during or after the period of the second dentition.

1. **Early Manifestations.**—In early infancy the condition is a blood-infection, and its symptoms are analogous to those in the secondary stage of the acquired disease, although visceral lesions, such as only occur in the tertiary period in acquired syphilis, are commonly found.

In the great majority of cases, infants who are the subjects of congenital syphilis are born without any obvious indication of the disease. The presence of snuffling breathing may indeed give grounds for a diagnosis from the very first; but generally for three or four weeks at least, one cannot recognise, by clinical examination alone, that they are other than healthy children.

(*a*) *General Symptoms* (Marasmus, Fever, Irritability).—Although most syphilitic babies seem well nourished to begin with, in a few instances, *wasting* and debility are the only symptoms noticed in the early weeks. This is often due to the presence of severe visceral disease, but occasionally it is caused by less serious conditions and responds at once to specific treatment.

The *fever* which is sometimes found during the early stage is generally attributed to the presence of complications from pyogenic organisms; but L. Findlay has given reasons for believing that it is sometimes due to the action of the spirochætes. Great *irritability*, especially during the night, is a common and characteristic occurrence.

(*b*) *Snuffles and Rash.*—The first definite symptoms to appear are nearly always nasal obstruction, with snuffling breathing, and a rash.

The *snuffling* is generally noticed first. It is often present at birth, and occasionally persists for a long time after the other symptoms have gone. It is sometimes absent; in 15 per cent. of my cases I was unable to get any history of it.[1] The

[1] When making inquiries, especially in the case of older children, regarding the presence of snuffles and a rash in infancy, it must be borne in mind that the mother's powers of observation, and her memory for such

snuffling varies in loudness and character according to the extent of the local lesion. Generally it has a dry sniffing sound owing to the scantiness of the nasal secretion, but in some cases there is a copious muco-purulent and hæmorrhagic discharge, and occasionally ulceration of the mucous membrane. When this is badly affected, the bridge of the nose becomes broadened and flattened, and sometimes the cartilages are destroyed and a permanent deformity of the nose results (Figs. 231 and 241).

Laryngitis, with thickening and sometimes ulceration of the mucous membrane, is common; and the hoarse cry which it causes is a most useful symptom in the diagnosis of early cases.

Fissuring of the lips (Figs. 229 to 231) *and of the anus* are very characteristic lesions. It usually extends on to the skin and leaves linear scars, which serve as a permanent record of its occurrence (Fig. 242). Small areas of eczema at the angles of the mouth, and condylomata there, or at the anus, are occasionally seen in young infants, but are much commoner at a later stage of the disease (p. 754).

The *rash* is the commonest of all the manifestations of congenital syphilis. It was said to have been absent in only 10 per cent. of my cases. In most cases it makes its appearance between the first and seventh weeks—seldom later than the fourth month—but in rare instances it may occur for the first time much later. I have never seen it present at birth in a viable child.

The most characteristic situations of the specific eruption at this age are the anus, genitals, buttocks, and thighs (Figs. 232 and 233) the eyebrows, lips, and chin (Fig. 228), and the palms and soles. It varies greatly in extent and severity in different cases. In some, a few little rounded scaly brownish patches in one of these situations is all that is to be seen; in others, the rash may be almost universal. The front of the chest and abdomen are the places least often affected. Sometimes, when the eruption is severe, it is so complicated by eczema or erythema that its special characters are difficult to recognise.

details, are often curiously defective. I have several times known a mother to deny, in good faith, that her child had ever had either of these symptoms, although I had notes of having seen him with both of them.

FIG. 228.—Eruption. Girl of 3 months.

FIG. 229.—Fissured Lips. Girl of 4 months.

FIG. 230.—Fissured Lips. (Sir H. Stiles' case.)

FIG. 231.—Nasal Deformity and Fissured Lips. Boy of 3 months.

CONGENITAL SYPHILIS.

The type of the eruption varies in different cases and in different positions. Roseola, which is so generally found in the acquired disease, scarcely ever occurs in congenital syphilis.

FIG. 232.—Congenital Syphilis. Eruption. Same case as Fig. 228.

FIG. 233.—Congenital Syphilis. Pemphigus of Soles. (Dr J. S. Fowler's case.)

The commonest lesions are small rounded scaling maculæ or large flat papules, with a yellowish-red or coppery tint, which tend to run together into blotches. Smaller papules, acuminate or flat, also occur; they also show desquamation. Pustules and boils in various situations are often met with; and, in new-born

children with the disease in a very severe form, bullous eruptions sometimes occur.

The palms and soles are often affected by an erythema which is followed by profuse desquamation (Fig. 234); this often leaves the skin with a shiny red surface, as if it had been brushed over with gum. Occasionally purulent bullæ form in this situation in new-born children (Fig. 233).

None of the syphilitic rashes are accompanied by itching; and all of them usually yield rapidly to specific treatment.

FIG. 234.—Desquamation of Soles. (Dr J. S. Fowler's case.)

FIG. 235.—"Syphilitic Wig." Girl of 10 weeks.

CONGENITAL SYPHILIS.

Affections of the hair and nails are not uncommon. The scalp is often scaly and the hair scanty. In a few cases, areas of alopecia appear on the forehead and elsewhere with long hair close to them. This gives rise to the appearance described by W. Colman and R. Hutchison as the "*syphilitic wig*" (Fig. 235).

In many cases the hair of the eyebrows and the eyelashes are largely destroyed. This, with the thickening of the eyelids, produces a characteristic appearance which is often helpful, in later childhood, in the diagnosis of syphilis (Fig. 245).

Inflammation of the matrix of the nails (onychia) is occasionally met with. It may be limited to one finger or may affect them all (Fig. 236).

(*c*) *Disease of the Bones.*—As we have already seen (p. 61, Figs. 34 to 39) *bossing of the cranium* when very well marked is probably always due to congenital syphilis—usually with rickets as a complication.

When *craniotabes* is extensive, it also is often due to a combination of rickets and syphilis; but occasionally in untreated cases of congenital syphilis we find a very severe degree of it without any sign of rickets.

Pseudo-paralysis of the extremities from *epiphysitis* is one of the commonest and most important symptoms of congenital

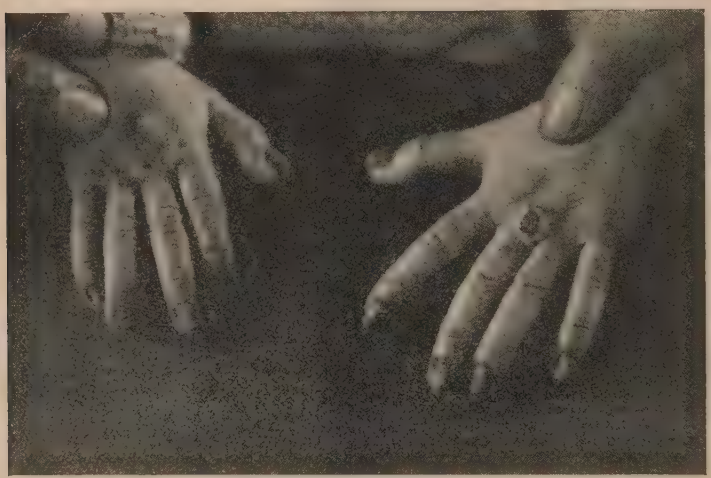


FIG. 236.—Congenital Syphilis. Onychia. Girl of 16 months.

syphilis. The lesions are very often, if not always, multiple and may occur in any of the limbs, but the commonest sites are the upper end of the humerus and the vicinity of the elbow. Usually it is noticed that the child never moves the affected limb voluntarily, and cries when it is touched or moved for him; but occasionally the condition may occur without pain or tenderness.

There may be little or no ascertainable enlargement of the affected bones; and suppuration, in early infancy, is very rare. The condition generally occurs between the fourth and sixteenth weeks of life. It is sometimes met with apart from any other specific symptom, and its presence at once indicates the nature of the case.

Syphilitic dactylitis from gummatous periostitis (Fig. 51) occasionally occurs in older infants. Joint affections are extremely rare in early infancy.

(*d*) *Visceral Lesions.*—The liver and spleen are the internal organs most commonly affected in infancy. Enlargement of the *spleen* is found in about half the cases examined during life, and in a much larger proportion of still-born fœtuses. These enlarged spleens show no distinctive features; the condition seems to be one of simple hypertrophy. The enlargement often persists long after the other early symptoms subside; it is apt to be specially marked in cases in which there is severe bossing of the cranial bones.

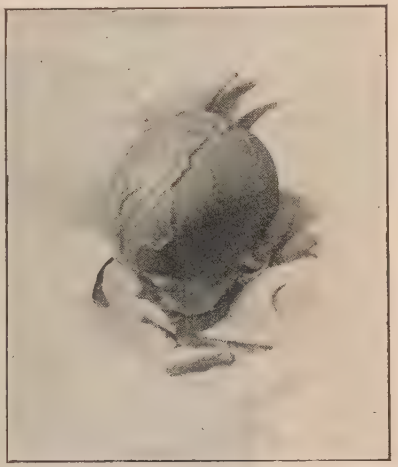


FIG. 237.—Congenital Syphilis. Enlargement of Superficial Veins. Boy of 6 months.

The *liver* is often severely affected, though not necessarily enlarged; and this may sometimes account for a perplexing failure of anti-syphilitic treatment. In infants who die early from congenital syphilis, the liver is frequently found to show interstitial hepatitis on microscopical examination, although little change may be visible to the naked eye. In some cases its section is studded over with miliary gummata. Acute perihepatitis, with ascites, occasionally occurs, or chronic pericholangitis with obliteration of the bile-ducts (p. 307). Large gummata do not occur at this stage. Jaundice is uncommon in syphilitic infants; when present, the case is usually fatal.

Ulceration of the *stomach and bowels* has been described but is rarely seen. The *kidneys* also are rarely affected, but a number of cases of syphilitic nephritis have been described.[1]

Swelling of the *testicles*, in infants under six weeks, is generally specific in origin. It generally disappears under treatment.

[1] Geo. Carpenter, *Brit. Journ. Child. Dis.*, March 1908, v., 94.

Enlargement of the *lymphatic glands* is not so prominent a feature in congenital as in acquired syphilis; and, when present, is often due to secondary infections.

Congenital syphilis is given as one of the causes of malformations of the *heart;* and they certainly seem to occur rather more frequently in syphilitic than in otherwise healthy infants. Enlargement of the superficial veins on the scalp (Fig. 237) and elsewhere has been described by Edmond Fournier[1] and others, and is a common symptom which is sometimes useful in diagnosis. As has been already mentioned (p. 404), a tendency

FIG. 238.—Congenital Syphilis. Condylomata. Girl of 2 years.

to hæmorrhage sometimes occurs[2]; it is probably due to disease of the blood-vessels.

An interstitial affection of the *lungs*, "white pneumonia," has been described by Virchow as sometimes present at birth, or during the first few days of life.

Syphilitic affections of the nervous system are not very common, but we occasionally meet with meningitis, hydrocephalus, and encephalitis, and the latter generally leads to severe mental defect. Many syphilitic infants take fits.

The *eyes* are not very rarely the seat of disseminated

[1] "Des Dystrophies Veineuses de l'Hérédo-syphilis," *Rev. d'Hygiène et de Méd. Infant.*, 1902, i., 26.

[2] Fr. Mracek, *Vierteljahrschr. f. Dermat. u. Syph.*, 1887, xiv., 117.

choroiditis, optic neuritis, and atrophy, and irido-cyclitis. Uncomplicated iritis is very rare, but occasionally occurs between the third and six months. Sloughing of the cornea is occasionally met with in ill-nourished babies.

In the not very common case of a syphilitic mother having a number of syphilitic children who survive early infancy, it is interesting to find that, not infrequently, one child after another shows the disease in the same organs or tissues[1]—*e.g.* in the nervous system, the bones, the liver, or the aorta.[2]

In dealing with syphilitic infants, we have always to bear in mind that they have a very great tendency to acquire all sorts of pyogenic infections, so that they often suffer severely from non-specific as well as specific lesions. The disease also leads to a serious lowering of the general vitality which often outlasts its obviously specific manifestations; so that an infant who seems to have recovered entirely, and who has all the appearances of perfect health, may collapse suddenly during an acute attack of pneumonia or diarrhœa which would not have proved fatal to a healthy child.

2. **Intermediate Symptoms.**—After the early manifestations of the disease have ceased to appear, which occurs usually in a few months, or at most before the end of the first year, there are in the majority of cases no further active symptoms of a characteristic kind for three or four years or more. Occasionally, however, definite specific lesions occur, especially in the skin.

The commonest of these are *condylomata*, which are found mostly at the margin of the anus (Fig. 238), often during the second or third year. When present, they prove conclusively the syphilitic nature of the case. They are, however, more characteristic of the acquired than of the congenital form of the disease. Mucous tubercles are sometimes found at the corners of the mouth and elsewhere; and circum-oral eczema, which is commoner at a later stage, may also occur.

Rarely, we find other definitely specific lesions, such as syphilitic dactylitis, and gummata may form in some of the internal organs as in the liver, heart, and thyroid. I have also observed cases in which syphilitic retinitis and choroiditis occurred at this stage.

[1] J. Thomson, *Scot. Med. and Surg. Journ.*, Jan. 1899, iv., 31.
[2] Neugebauer, *Wien. klin. Wochenschr.*, 1914, xxvii., No. 17, 503.

3. **Later Manifestations.**—The term "syphilis tarda" used to be applied to the manifestations of the disease which appear in later childhood—usually during the period of the second dentition—because it was noticed that, in many cases in which they occurred, no history of early symptoms could be obtained. The lesions affect many systems and organs, and resemble the tertiary manifestations of the acquired disease. Their chief varieties are as follows:—

(1) *General Symptoms.*—Before any characteristic lesions make their appearance, the children are often noticed to be pale and anæmic; and they are generally stunted in growth, and lacking in energy.

(2) *Affections of the Skin and Mucous Membranes.*—Skin affections are much less common in congenital than in acquired syphilis. L. Findlay and J. F. Watson[1] have, however, drawn attention to the frequency of circum-oral eczema (Fig. 239). This occurs at one or both angles of the mouth, and often spreads outwards on to the cheeks, and sometimes to the mucous membrane of the lips. The patches are red in colour, and irregular in outline, and their margins may be either sharply cut or ill-defined. The surface is generally dry and scaly. The condition often occurs when there is no other definite sign of syphilis, and it is very resistant to other than specific treatment. Its nature is only proved by the Wassermann test and by the effect of anti-syphilitic treatment.

Gummatous infiltrations of the skin and mucous membranes (*e.g.* gumma of the tongue) and psoriasis palmaris are very rarely met with.

Phagedænic ulceration and sloughing of the skin and mucous membranes, which resemble lupus in their results, but progress much more rapidly, are not very uncommon. They often affect the nose, palate, and pharynx (Fig. 241). They may also involve large areas of the skin and subcutaneous tissues on the buttocks or elsewhere on the body without any apparent local determining cause. Great loss of tissue and extensive scarring result (Fig. 243).

(3) *Bone Conditions.*—A slightly tender swelling of one or more of the long bones, with severe nocturnal pain, is one of the commonest manifestations of the disease at this stage. It is caused by specific osteo-periostitis and is commonest

[1] *Lancet*, 29th March 1913, i., 875.

FIG. 239.—Circum-oral Eczema. Boy of $4\frac{3}{12}$ years. (Dr L. Findlay's case.)

FIG. 240.—Square forehead, keratitis, depressed bridge of nose, characteristic teeth. Boy of 10 years.

FIG. 241.—Square forehead, phagedænic ulceration of nose, ear, and neck. Girl of 14 years.

FIG. 242.—Broad bridge of nose, fissuring round mouth. Girl of 16 years.

in the tibiæ and ulnæ, but also affects the femur, fibula, humerus, radius, and clavicles. It occurs in two types.

The *sclerosing type* causes much thickening of the bone with alteration in its shape and sometimes overgrowth in length. When severe, it leads to the so-called "sabre tibia" (Fig. 244). The apparent bowing of the bone in this condition is due to deposition of new bone on its anterior aspect, and not to true bending such as occurs in the case of rickety deformity of the tibiæ which bears a superficial resemblance to it.

In the other variety, which is less frequently met with, there is *necrosis of the bone with gummatous softening* over it. This breaks down, leading to abscess and sinus-formation. Cases of this type are apt to be mistaken for tuberculous bone disease; but the use of X-rays, the Wassermann test, and the result of specific treatment prove their real nature.

FIG. 243.—Congenital Syphilis. Scars from phagedænic ulceration over sacrum and left trochanter. Boy of 9 years.

(4) *Joint Affections.*—Far the commonest syphilitic joint affection is the relatively painless, usually symmetrical arthritis of the knees and other joints with effusion, which has been already described (p. 72, Fig. 44). Still[1] has drawn attention to another less common form of joint disease which resembles osteo-arthritis.

(5) *Visceral Disease.*—(*a*) The *liver* is rarely affected either with cirrhosis, amyloid disease, or gummata. (*b*) The *spleen* is enlarged in exceptional cases. (*c*) The chief specific affection of the *kidneys* is paroxysmal hæmoglobinuria, which almost always occurs in children who are the subjects of congenital syphilis. (*d*) Syphilitic *endarteritis* occasionally occurs, and may lead to aortic disease. Most of the cases of aneurism in children are due to this,[2] and it is also probably responsible for the

[1] *Common Disorders and Diseases of Childhood*, 3rd Ed., 1915, 812.

[2] E. Bronson and G. A. Sutherland, "Ruptured Aneurisms in Childhood," *Brit. Journ. Dis. Child.*, 1918, xv., 241.

cases of hemiplegia which we sometimes meet with in syphilitic children. The subjects of Raynaud's disease also are often found to have this disease. (*e*) Much the most important lesion of the nervous system is that which gives rise to the form of progressive dementia which has already been discussed in Chapter XXXII. (p. 681). Certain cases of *epilepsy* have been shown to be of specific origin by the presence of a positive Wassermann reaction, and by the striking effect of anti-syphilitic treatment. *Gummatous tumours of the brain* are very uncommon, but a few have been reported which disappeared rapidly under treatment with mercury and iodide.

FIG. 244.—Congenital Syphilis. Nodes on tibiæ. Girl of 11 years.

(*f*) *Affections of the eyes.* Interstitial keratitis is one of the commonest late manifestations of the disease. It usually begins insidiously with a slight cloudiness of the cornea, without pain. This, after gradually increasing for a time, slowly disappears, and in most cases leaves the sight unaffected. In severe cases, however, a certain amount of permanent haziness, and occasionally dense leucomatous patches are left which interfere with vision. The condition is curious in this respect, that, although certainly due to congenital syphilis in the majority of cases, it differs from nearly all the other manifestations of the disease in being little, if at all, influenced by specific treatment. I have several times seen it set in in children who had been under constant treatment with

mercury and iodide for weeks or months, and L. Findlay mentions a case which began after the Wassermann reaction had become negative as the result of a prolonged course of neosalvarsan and mercury. *Iritis* may occur alone, or along with keratitis, and choroiditis also occasionally develops at this stage. (*g*) The disease of the ears which is characteristic of congenital syphilis consists in an *affection of the internal ear* which rapidly leads, in most cases, to complete and permanent deafness. It generally occurs after puberty, and is often bilateral. (*h*) The peculiar dental deformity known as "Hutchinson's teeth," though only seen at this period of life, is due to disease in early infancy. It has been considered in Chapter III. (p. 55).

FIG. 245.—Congenital Syphilis. Loss of eyelashes, thickened eyelids, atrophy of alæ nasi. Same case as Fig. 228, at 12 months.

Diagnosis. — It is rare to get much help in the diagnosis of congenital syphilis from interrogating the mother about her own symptoms. We have generally to trust to the history, and to the presence of the early manifestations of the disease which we have described. If the Wassermann reaction can be done, either in the child or in the mother, by a competent bacteriologist, it is generally conclusive at all ages. We frequently obtain no history of specific symptoms in the mother.

In the *intermediate* stage of the disease, our suspicions should always be aroused if we find thickening of the eyelids, with loss of eyelashes or signs of past iritis, especially if there is also obstruction of the nasal passages with atrophy of the alæ nasi (Fig. 245). Fissuring of the mucous membrane of the lips and adjoining skin, and a severe degree of depression of the bridge of the nose, are sure indications of the presence of the disease. Prominent bossing or thickening of the cranial

bones also suggests strongly the presence of syphilis; and, when this condition is met with along with evidence of a moderate amount of past hydrocephalus, it is, I think, pathognomonic.

In *later childhood and adolescence*, the presence of a congenital syphilitic taint may be diagnosed (*a*) if traces of past syphilitic disease in infancy are found; (*b*) if the morbid condition from which they are now suffering is of an undoubtedly specific character.

(*a*) *Traces of Past Syphilitic Disease.*—Many syphilitic children grow up showing no trace of their past specific ailments. The permanent alterations in the teeth, bones, etc., are only found in a minority of the cases, so that their absence proves nothing. The traces of past syphilitic disease which are most often found are the following:—

(1) The characteristic deformity of the permanent teeth, the importance of which has already been mentioned (p. 55).

(2) Absorption-patches in the choroid, usually situated towards the periphery.

(3) Bossing of the head, in older children, although often less distinct than that seen in young infants, is important. It is usually represented in older children by a general thickening of the bone which gives the forehead a heavy, square appearance.

(4) Depression or broadening of the bridge of the nose.

(5) Fissuring of the lips and adjacent skin.

(*b*) *Essentially or Probably Specific Lesions.*—The commonest of the morbid conditions which are so characteristic of congenital syphilis that their presence is suspicious, or even pathognomonic of the disease, are as follows:—

(1) Interstitial keratitis.

(2) Sudden incurable deafness from disease of the internal ears.

(3) The occurrence—most commonly on the tibiæ—of periosteal nodes which are painful at night.

(4) The spontaneous occurrence of subacute or chronic synovitis of both knees, with comparatively little pain or stiffness. This is common in syphilis, and very rare from any other cause.

(5) Phagedænic ulceration of one of the mucous membranes such as that of the nose, palate, or throat, or of the skin.

(6) Circum-oral eczema.

(7) Progressive dementia.

Treatment.

There can be little doubt that the prophylaxis and curative treatment of congenital syphilis has often in the past been most unsatisfactory, and that a very large proportion of the cases have either died or continued syphilitic which, with our present knowledge, ought to be entirely cured so as to grow up in perfect health.

Prophylaxis.—The measures to be taken with a view to the prevention of congenital syphilis are given as follows by Dr Leonard Findlay.

(1) All cases of acquired syphilis must be treated as early, and as thoroughly, as possible; and, to this end, notification of the disease is most desirable. While there are, of course, obvious reasons why it will be very difficult to bring this into operation, there can be no doubt that it should be introduced, and that this will be done in time.

(2) The marriage of syphilitic persons should be delayed until they have been four years under treatment, and have had no symptoms of the disease for two years at least. If this precaution is carried out, it will be sufficient in such a large proportion of the cases that the risk of exceptional failure may be taken.

If the parents have been subjected to early and thorough treatment with salvarsan, until the Wassermann reaction has become negative and has remained constantly so for a year, marriage may be safely allowed. If the treatment has only begun at a late period of the disease, the risk is far greater, as the reaction is apt, in these circumstances, to become positive again.

(3) When a syphilitic mother becomes pregnant, she must always be subjected to thorough treatment with mercurial inunction and salvarsan. If this is done, there is every chance that the child will not only be born healthy, but will remain so; and if the treatment is continued after delivery, the subsequent children will also be free from the disease. The injections may be followed by headache and sickness for twelve hours, but the patients feel well at other times, and there is no interference with the course of gestation. When the syphilitic mother is properly treated, the health of the child can almost always be guaranteed.

Curative Treatment.—The chief forms of medicine which are useful in the treatment of congenital syphilis are mercury and salvarsan in its various forms. Both of these should always be used; mercury alone is only successful in curing the disease in a relatively small proportion of cases.

Iodide of potash is valuable in the later manifestations of the disease, and is especially efficacious in the bone conditions.

Treatment by Mercury.—Grey powder, in doses of $\frac{1}{2}$ to 1 gr. thrice daily and 2 grs. in older children, has been the form of mercury most commonly used in this country, and, if there is a tendency to diarrhœa, small doses of Dover's powder may be added; 10 to 30 minims of the solution of the perchloride (B.P.) may also be given. The most satisfactory way, however, of using the drug is by *inunction.* This, if it is properly carried out, is not only more effectual than grey powder, but has the advantage that it does not set up diarrhœa. A piece of unguentum hydrargyri the size of a pea should be used once a day—small fragments of it being rubbed into the skin until they disappear. On the first day, the inunction should be made into the abdomen, and on the second, into the back; then one day should be given to each axilla and to each groin, and then the abdomen should be used again, and so on. The skin must be washed with soap and water before each application. The occurrence of stomatitis in infancy is extremely rare.

During the second year, the inunctions should be repeated regularly every two months, and the Wassermann reaction taken from time to time. If condylomata or mucous papules are present, they should be dusted with calomel.

At all ages, careful tonic as well as mercurial treatment is of great importance in the later stages; and cod-liver oil, iodide of iron, and other chalybeate preparations are often useful. Dietetic and hygienic details must also be attended to.

Treatment by Salvarsan and its Allies.[1]—When salvarsan was introduced by Ehrlich and Hatta in 1911, it was recognised that this compound formed the most powerful spirochæticide yet discovered. At the present time, salvarsan and its various allies are among the most efficient aids which we possess in the treatment of congenital syphilis.

Varieties and Combinations of the Drug.—While the original

[1] This section has been kindly supplied by Mr John Fraser, Surgeon to the Royal Edinburgh Hospital for Sick Children.

salvarsan ("606") is still in common use, there are various other forms now available—*e.g.*, neo-salvarsan, kharsivan and neo-kharsivan, novarsol Ducatte, galyl and novarsenobenzol (Billon); more recently silver salvarsan has been recommended by Gennerich. Of the different varieties, neo-salvarsan, novarsol Ducatte, and silver salvarsan are claimed to be the least toxic.

While many clinicians rely entirely on salvarsan or one of its varieties, there are great advantages in combining these drugs with mercury or potassium iodide. Mercury applied by inunction is employed in the early stages of the disease; potassium iodide is used in the later stages (lues tarda).

Yet another combination of the drug is the so-called salvarsanised serum. By this method the serum of a person already treated by repeated injections of salvarsan is applied to a second patient, or the serum may be used for the further treatment of the original sufferer (auto-salvarsanised serum). The serum method is generally used as an intra-thecal injection for various nervous types of congenital syphilis.

Dosage.—For infants, salvarsan is generally given in an amount of 0·005 gm. per kilogramme of body weight. In an average infant of one to two months, a dose of 0·02 gm. is therefore administered. There are many who believe that this system is on too small a scale for a baby of one to two months; they would recommend a dosage of 0·05 gm. increased to 0·2 gm. The consensus of opinion is in support of the larger amounts of the drug.

The amount of kharsivan is very similar to that of salvarsan. The doses of neo-salvarsan and neo-kharsivan are one-third greater. With neo-salvarsan and neo-kharsivan an initial dose of 0·1 gm. to 0·15 gm. increasing to 0·2 to 0·3 gm. may be given with safety in infants of one to two months. When silver salvarsan is used, the dose is smaller. Gennerich uses 0·1 to 0·15 gm. dissolved in 20 to 30 c.c. of 0·4 per cent. salt solution for adults. For infants of one to two months, an initial dose of 0·005 gm. is probably the best.

Methods of Administration.—Salvarsan or one of its various compounds may be administered intra-muscularly, intra-venously, or intra-thecally. On occasions it has been given by two other methods—through the medium of the mother's milk, or rectally. These two last-named methods need not be

considered ; for by them the dosage cannot be controlled, and moreover, when administered by these routes, the drug loses much of its potency.

The intra-thecal injection is employed in certain varieties of cerebral syphilis. The drug in solution should not be used in this method, as the injection may be followed by severe girdle pains, incontinence, anæsthesia, ataxia, or even complete paralysis of the lower extremities. If the intra-thecal route is followed, salvarsanised serum should be used.

The Intra-muscular Route.—In view of certain difficulties associated with intravenous injection, the intra-muscular route is attractive from the point of view of facility. However, when the drug in saline solution is injected, there are serious drawbacks to its use—there is intense pain, induration and redness, sloughing and ulceration. These complications do not appear in every case, and they are more likely to develop after repeated injections than after a primary one, yet the possibility of their appearance contra-indicates this method of injection for infants.

Two procedures are in use intended to overcome these drawbacks. It is said that if the drug is dissolved in 0·5 per cent. glucose in saline, induration and necrosis is unlikely to occur. Another method has been suggested by Harrison, White, and Mills. The drug is dissolved in 1 c.c. of a 4 per cent. solution of stovaine, and the volume of the injection is made up to 2 c.c. with creocamph. cream, melting at 15° C. (B. W. & Co.'s formula). In children, 2 per cent. stovaine should be substituted for the 4 per cent.

The Intra-venous Route.—This is the method of choice in the administration of the drug, for the associated advantages are great. These advantages briefly are, that the drug may be administered in concentrated solutions, that there is no local tissue-disturbance, and that there is an early and effective response in the character of the disease.

In certain cases, bad effects result from intra-venous injection. There may be vomiting, diarrhœa, rigors, fever, cyanosis, and in severe cases coma may result. These complications are more likely to appear in the severer forms of the disease. Moderation in dosage will lessen their tendency to appear, and as it is possible that certain of the features may have an anaphylactic basis, it is a wise procedure to give two or three drops of

1/5000 adrenalin hypodermically, immediately before the injection.

The Technique of the Injection.—There are four situations in which the injection has been given—the basilic vein at the bend of the elbow, the external jugular vein, the lateral scalp vein (branches of the temporal vein), and the superior longitudinal sinus. In older children the elbow vein is generally chosen and the injection is given percutaneously with a record syringe. In infants, the elbow vein is generally so small that it is only accessible through an open operation. If this is to be avoided, one of the other three sites must be chosen.

The external jugular vein is a difficult one to enter with a needle. Apart from its mobility, which is considerable, the situation between the shoulder and head is difficult of access in a small child.

There are some who favour the superior longitudinal sinus. The needle is inserted in the middle line in the posterior half of the anterior fontanelle at an angle of 25° to 30°, the point of the needle being directed towards the occiput. The injection is made slowly. The method is associated with considerable danger, for if the needle passes through the sinus wall, as it very easily may, the injection will make its way into the meninges, and the results of this are very unpleasant.

At the present time, many favour the scalp vein method. It was first introduced by Noegerrath and it has many advantages. It can be used in the smallest children. The veins are rendered more prominent as the child cries, and no anæsthesia is therefore required; the veins are fixed in the scalp aponeurosis and access is correspondingly easy; the veins are numerous and repeated injections may therefore be given.

The method of injection is as follows:—The child is firmly wrapped up in a blanket, the head is elevated slightly on a small hard pillow and it is firmly held in position. The drug is made up in a concentrated solution so as to hasten injection—3 or 4 c.c. of saline being used as a solvent. A 5 c.c. syringe carrying a No. 1 needle is the most suitable. In very small veins a No. 15 needle may be required. The vein is rendered prominent by making pressure with the finger immediately in front of the ear, and the needle, disconnected

from the syringe, is inserted into the vein. A steady drop of blood from the needle may be taken to mean that the needle is properly *in situ*. The syringe is now connected up to the needle and the injection made slowly. If the vein is not entered, the needle should be withdrawn and a fresh attempt made.

The Technique of the Percutaneous Operation.—When this method is employed, the elbow vein is the most suitable, but it presupposes that the vein is large enough to be apparent through the skin; the method is therefore more suitable in older children.

The forearm and elbow are rubbed vigorously for a few minutes and a rubber tourniquet is applied so as to make the vein as prominent as possible. The tourniquet is fastened with a slip knot, so that it may be easily removed. After the part is sterilised, the needle is inserted obliquely with the flat surface uppermost; in this way there is less risk of the needle point passing through the deep wall of the vein. A free escape of blood from the needle is an indication that the vein lumen has been entered. The tourniquet is now removed; the syringe, filled with the solution, is connected with the needle and the drug is injected. It is important that none of the drug shall come into contact with the skin wound, and therefore the injection must be completed before the needle is removed. If this detail is not attended to, a slough may appear at the point of injection. A small pad and bandage is applied at the point of injection.

The Technique of the Open Operation.—It may occasionally happen that all attempts at percutaneous injection fail, and recourse must be had to the open operation. The elbow and the external jugular veins are the situations of choice.

The vein is exposed through a small oblique incision and, with the aid of a dissector, a sufficiency of it is freed. Two fine catgut ligatures are slipped round the vein, leaving a space of about half an inch between them. The distal ligature is tied, but allowed to remain long. It serves as a retractor to pull the vein into prominence. The proximal ligature remains loose. The injection may be given by means of a needle and syringe or by a glass or metal canula. If the former method is chosen, the needle is passed into the vein, the injection is given, and as the needle is withdrawn, the

proximal ligature is tied. If the canula method is used, a small oblique slit is made into the vein with fine sharp-pointed scissors. By pressing the end of the canula upon the apex of the < slit, the vein lumen is easily entered. Before insertion, the canula is connected with a reservoir containing a small quantity of saline solution, and while this is passing into the vein, the solution of the drug is added to the reservoir. As the last of the injection leaves the reservoir, an additional small quantity of saline is added, and this suffices to wash the remainder of the drug into the vein. As the canula is withdrawn, the central ligature is tied. The skin wound is closed with sutures or clips.

The Results of Treatment.—Personal experience has been confined to the following preparations:—The original salvarsan ("606"), neo-salvarsan ("914"), galyl, and novarsenobenzol (Billon). It may be of interest to briefly contrast these from the point of view of benefits and disadvantages.

Salvarsan ("606").—A statistical study of forty cases treated by this method has been made, and it has led to the fundamental conclusion that salvarsan is a most potent remedy, and with proper dosage and technique it can be used with safety in the case of the youngest child. In very severe cases such as those with pemphigus, extreme marasmus, etc., the initial dose should be reduced from 0·01 gm. to perhaps half that amount.

Mortality.—Of the forty cases which came under treatment, seven subsequently succumbed; of these, six were children under six months. Three of the fatal cases were examples of severe skin infection, and death occurred at periods of forty-eight hours, three days, and five days after the injection. It is difficult to believe that the injection had any direct influence on the fatal issue, as post-mortem examination revealed extensive visceral disease in all of these cases.

Of the remaining four cases, one was an example of extreme marasmus: the wasting continued and death ensued in three weeks. One died during a convulsion two and a half months after the injection. The remaining two cases died six months later from broncho-pneumonia.

Results.—The beneficial results of the injections were striking. The skin lesions, rashes, fissures, ulcers, and condylomata yielded readily, and, on an average, in from ten to

fourteen days the lesions had disappeared. Deep fissures were the most persistent; in some of these, three weeks elapsed before healing was complete.

Coryza proved one of the most intractable symptoms from the point of view of improvement. While the injection always produced an immediate improvement, six months sometimes elapsed before the symptoms disappeared. This intractability probably resulted from a mixed infection of the mucous membrane. Epistaxis and hoarseness quickly disappeared. Syphilitic onychia rapidly improved. The nails were shed and healthy nails had reformed in two months. Epiphysitis showed a most striking improvement. Within a week all pain had disappeared, and at the end of a fortnight the child was generally using the limb freely. Specific synovitis and periostitis, later indications of the disease, yield somewhat slowly to salvarsan, but such a slow improvement is in keeping with the pathological conditions which exist. Two to three months elapse before the benefit is appreciable, and many of the cases require adjuvant treatment with mercury and potassium iodide. The results in enlargement of the liver are encouraging, though six to eight months may elapse before the visceral enlargement disappears. Eye-symptoms, with the exception of keratitis, rapidly improve. In cases of keratitis the improvement is generally slow.

Recurrence of Symptoms.—In only a single case was there a recurrence of symptoms. This was a child who had been treated for epiphysitis and who, two months later, developed condylomata. These rapidly disappeared after a second injection.

Neo-Salvarsan ("914").—Opinion is divided as to whether "914" is equal therapeutically to "606." In immediate effect it is difficult to choose between them, but the writer's experience has been that "914" is not so powerful or permanent in its therapeutic effect. As to toxicity, it would appear that "914" has the advantage, but it must be remembered that "914" from its liability to decompose may be followed by serious after-results.

Galyl.—Experience with this drug has been disappointing. Its immediate effects are by no means as powerful as those of salvarsan and cases treated by it have shown a tendency to relapse.

Novarsenobenzol (*Billon*).—The results from the use of this drug have been consistently good, and in every way comparable to those obtained with salvarsan.

Acquired Syphilis.

Acquired syphilis is occasionally seen in infancy and childhood, and its symptoms and treatment differ in no important respect from those of the same disease in adults.

The primary sore is most frequently found in the mouth or on the lips. This may be due to the infection having been communicated directly by kissing, but probably it arises quite as often from the child's indiscriminate habit of picking up all sorts of dirty things and putting them into his mouth.

The symptoms, apart from the absence of snuffles, are similar to those of the hereditary form of the disease. Condylomata are a prominent feature (Fig. 238). The acquired disease, as has been already mentioned, is very apt to spread by contagion.

CHAPTER XXXVII

ON TUBERCULOSIS

TUBERCULOSIS is one of the commonest and most interesting, as well as one of the most serious of the diseases of childhood. For the physician it has the great attraction that, when taken in time, it is amenable to treatment to a surprising extent.

Active and Latent Cases.—In studying the subject clinically, it is well to keep in mind that we have to deal with two types of tuberculous children. In the one—*active tuberculosis*—the disease has produced lesions which are causing local or general symptoms, interfering actively with the child's health, and threatening his life. The other—*latent tuberculosis*—is present in the body in such forms and positions that it may not give rise to any lesions demonstrable by ordinary clinical methods, and does not apparently interfere with the child's well-being, or prevent his gaining in weight and vigour. This condition, which we may also call "*tuberculous infection*," is much commoner than active tuberculosis. Though not "suffering from" tuberculosis, these patients are nevertheless "*tuberculous children*." Under favourable conditions, the latent tuberculous infection which they harbour may, and very likely will, remain harmless during a long lifetime. It continues, however, to be a menace to the child's health, as any transient local irritation or lowering of the general resistance may arouse it dangerously from its state of quiescence; also because its presence may so lessen the resistance of the child's bones or other tissues as to make them extremely liable to local tuberculous infections, to which in ordinary health they are immune.

From a pathological point of view it may seem superfluous to dwell much on the differences between these two groups of tuberculous cases. Clinically, however, it is well worth while to do so, because their confusion has so often aggravated,

unnecessarily, the difficulties of interpreting the clinical and pathological facts, that we should always try to recognise, if possible, to which type any case that we are called to treat belongs.

Recent Increase of Knowledge. — Until comparatively recent times, curiously little was known about many of the most interesting and important facts regarding tuberculosis. Few authorities, for example, seem to have recognised the full significance of its infectiousness, although Villemin demonstrated this fact in 1868, and Koch discovered the tubercle bacillus in 1882. At the present time, our knowledge of the ways and works of the bacillus of tuberculosis has grown so much, that if we would only make a logical and common-sense use of what we know, we should soon be able to control the ravages of the disease to an extent we could scarcely have hoped for a few years ago.

This important growth of our knowledge regarding tuberculosis has come, of course, largely from the pathologists and bacteriologists. They have worked out the ways in which the disease spreads in animals, and its propagation from one to another by contact, through the air, and in milk. They have given us the tuberculin tests, and are now showing how to differentiate the human and bovine types of tuberculosis accurately from one another. We owe not a little also to clinical observation, especially that of operating surgeons who, with the help of the X-rays, have taught us much about the advance and retrogression of tuberculous processes in the bones and other tissues.

Frequency and Age Incidence. — Estimations of the frequency of tuberculosis, founded on ordinary clinical observations only, although interesting and useful in their place, can have but a limited value. They deal, in most instances, only with the active forms of the disease, and not with the latent cases, except in those instances in which the von Pirquet or other tuberculin test has been used. The results of post-mortem investigation, when intelligently viewed, are generally of greater importance; but a satisfactory and well-balanced view of the subject is only to be obtained by a careful comparison of the clinical and pathological facts.

It is easy to see why tuberculosis is so common in young children, and why it affects them so severely. Not only are

they much more liable to get bovine infection from the large amount of unboiled milk that they often drink, but they also run a far greater risk of taking human tuberculosis, because in this climate so much of their lives has to be spent indoors, in close and continuous contact with adults, and with carpets and furniture which retain and transmit infection. If anyone in the house has active pulmonary phthisis, and has not been carefully trained in the ways of preventing the spread of the disease, the young children can hardly fail to become infected.

The young child is also far more likely, when infected, to take the disease badly. His tissues, at their best, are prone to harbour micro-organismal disease; and they have less power than those of older persons to react against it so as to circumscribe its effects. Young children in towns are bound to be much less in the open air than their brothers and sisters of school age, and confinement to stuffy rooms predisposes them to take infection, by keeping the resistance of the tissues at a low level. Further, such "childish complaints" as measles, whooping-cough, and diarrhœa, notoriously lower the resistance still more.

Tuberculous disease in infancy and childhood is important, not only because of its serious results in early life, but also because most of the active tuberculosis met with in adults is almost certainly a sequel to latent forms of the disease acquired in childhood. If we aim at ridding the community of this scourge, therefore, our most hopeful line of action is the prevention and cure of the disease in early life.

Mortality.—The mortality from tuberculosis in childhood is very large indeed, both on the Continent and in this country. Harbitz (Christiania), Hamburger and Sluka (Vienna), and Comby (Paris) found tuberculous lesions, post-mortem, in 42·5, 40·0, and 38·5 per cent. of their cases, respectively; while Still, Colman, and J. W. Carr, at the Great Ormond Street and Victoria Children's Hospitals in London, found them in nearly a third of theirs. In the Edinburgh Children's Hospital the percentage of post-mortem tuberculous lesions was found by Shennan to be thirty-six.[1]

A large proportion of the deaths from tuberculosis occur in the second and third years of life. After the fourth year, the proportion is much smaller.

[1] "The Morbid Anatomy of Tuberculosis in Man," *Lancet*, 28th Feb. and 7th March 1914, i., 595 and 673.

During the last few years, under war conditions, the proportion of tuberculous cases seen at the Edinburgh Children's Hospital has increased considerably, both in the medical and surgical departments, and at the same time the type of the disease has become more serious.

Type of Bacillus and Portal of Entry. — There are, practically, only two important types of the tubercle bacillus—the *human*, usually inhaled in air contaminated by the expectoration of phthisical adults or acquired from infected food or fomites, and the *bovine*, ingested in raw milk from infected cows. The former passes mostly through the respiratory tract to the mediastinal glands; and the latter by the alimentary canal to those of the mesentery. The tonsils, by which the bacilli so often find an entrance, belong to both of these tracts.

The relative frequency of the two types of infection varies greatly in different communities, according to the prevalence of adult phthisis, on the one hand, and the condition of the milk supply and the habit of using raw milk on the other. In Vienna, for example, according to von Pirquet, the great bulk of tuberculous disease in childhood is caused by the human bacillus; while, in Edinburgh, the bovine bacillus has been shown by Mitchell, Fraser, Wang and others, to be responsible for the majority of the cases. When we look further into the incidence of tuberculous disease in the two cities, we find that the percentage of cases in the wards of the Edinburgh Children's Hospital which are diagnosed as abdominal tuberculosis, is more than seven times that of the same disease in the St Anna Kinderspital in Vienna; yet, in the latter city, pulmonary phthisis was at the same time nearly three times as common as with us. The proportion of tuberculous meningitis, which may be caused by either form of bacillus, was found to be not very different in the two cities (*i.e.*, Edinburgh, 2·0 per cent.; Vienna, 2·4 per cent.). These differences point to the greater risk of human infection in Vienna, owing to the much greater prevalence of adult phthisis there, and to the large amount of virulently tuberculous raw milk consumed by the Edinburgh children. It is also interesting to be told, as we have been by Professor von Pirquet, that in Vienna the drinking of unboiled milk is generally regarded with distaste, much as the eating of raw meat is with us. In Edinburgh, the dairies are very imperfectly supervised and controlled, and over 17 per cent. of specimens

of milk examined have been found to contain living tubercle bacilli.[1] Most of the hand-fed babies among the poor and many of those in the upper classes are still given all, or part, of their milk unboiled. Hence the deplorable fact that Edinburgh has a far larger proportion of abdominal tuberculosis than any other European city, with perhaps the single exception of Glasgow. The proportion of abdominal tuberculosis in the larger cities of the Eastern States in America, where the milk supply is usually very carefully supervised, is even smaller than it is in Vienna.

The Cutaneous Tuberculin Test of von Pirquet.—In the diagnosis of tuberculosis in young children, von Pirquet's test is often most valuable. At all ages, it is useful in demonstrating the presence of latent lesions; but in differentiating active tuberculous from non-tuberculous disease, a positive reaction is of far more importance in young children than in older people; because in them its significance is not confused by the possibility, or probability, of old lesions being present. We must remember, however, that in general tuberculosis, and in tuberculous meningitis, there is often no reaction. Unfortunately, the test gives no trustworthy assistance in deciding whether the infection is from a human or a bovine source.

The best method of applying it is as follows (M'Neil[2]).—A small circular area of epidermis the size of a pin's head is chafed off with the point of a needle, care being taken to avoid bleeding. On this denuded area of corium, the head of a darning needle charged with tuberculin is pressed in, with a rotary motion, forming a small bruised pit from which the fluid is rapidly absorbed. In the majority of cases the reaction is definitely positive or negative at the end of twenty-four hours; but in some it takes forty-eight hours, or even longer, before the full result is obtained. It is usually well to treat another spot in the same way, as a control, using only pure glycerine. When undiluted old tuberculin (Koch) is used, a much more trustworthy result is obtained than with the 25 per cent. dilution of it, which is often supplied for the purpose.

In the "scrofulous" type of child, with poor circulation, sore eyes, and chronic nasal discharge, the von Pirquet test is

[1] James Miller, *Edin. Med. Journ.*, Feb. 1914, xii., 156; A. P. Mitchell, *ibid.*, April 1914, xii., 315.

[2] *Brit. Med. Journ.*, 6th Nov. 1909, ii., 1335.

generally unadvisable, as it is apt to be followed by extensive ulceration which is long in healing.

The Primary Lesion.—It is held by many that there is frequently no primary tuberculous lesion at the point of entrance of the bacilli whether on the tonsil, lung, intestine, or elsewhere. It is probable, however, that von Pirquet, Ghon, Dunn, and others are right in believing that a primary lesion always exists in these localities, although it is usually so minute, and heals so rapidly, that it escapes observation in most cases. From this primary lesion, the bacilli are carried to the neighbouring lymphatic glands, which generally become caseous. As the disease spreads in the glands, the lymphatics become blocked, and the bacilli may spread back into the lungs or intestine; or, getting into the circulation, they may be carried to the meninges or other serous membranes; or general miliary tuberculosis may occur.

Differences in the Distribution of the Disease in Infancy and in Later Childhood.—The two types of bacilli cause very similar manifestations; these vary, however, considerably according to the age at which the patient is attacked. In early infancy the disease is apt to take the form of a general septicæmia and to be rapidly fatal; and any local disease is likely to spread to neighbouring tissues more rapidly and certainly than in older children. In early childhood there is a greater tendency for the lymphatic glands to be severely affected; and it is only when this first line of defence is broken down, that the disease is able to reach the lungs and other internal organs. The bones are also liable to be affected in young children under certain conditions. In older children the prognosis is always less unfavourable, other things being equal, as in them the disease frequently becomes localised and recovers under treatment.

General Tuberculosis.

In Infants.—When general tuberculosis occurs in babies, the symptoms are usually indistinguishable in the early stages from those of ordinary marasmus or dyspepsia. There is increasing debility and loss of weight, often with constipation and sickness, and occasionally convulsions occur. The temperature is generally normal or subnormal till the last few weeks, when there is often an irregular pyrexia, especially if the lungs are

badly affected. In this case, there may be increased rapidity of respiration and more or less cough. Usually there are signs of slight bronchitis only. The spleen is often enlarged. Death may occur from progressive debility, lung disease, or meningitis.

In Older Children.—When the disease occurs in older children, the symptoms are also very indefinite in the early stages, and we have chronic indigestion, loss of appetite and weight, languor, anæmia, irritability, and sleeplessness. Although nothing in the symptoms may be distinctive, there is sometimes a steadily increasing debility and cyanosis, in spite of all treatment, with an appearance of toxæmia, which is most suggestive of generalised tuberculosis. There is also often, though by no means always, a well-marked tuberculin reaction. Ophthalmoscopic examination reveals the presence of choroidal tubercles in a large proportion of the cases, and sometimes there is optic neuritis. Sooner or later some degree of fever sets in. The duration of the disease varies from a few weeks to many months. After the general symptoms have gone on for a varying time, the nature of the case may be cleared up by the occurrence of serious symptoms of disease in the abdomen, lungs, meninges, or elsewhere. A considerable degree of enlargement of the spleen is very commonly found.

Chronic broncho-pneumonia with pneumococcal toxæmia, and enteric, are two conditions which are apt to be mistaken for general tuberculosis.

Treatment.—By the time that general tuberculosis has advanced so far as to cause general symptoms, it is probably incapable of being cured by any treatment; although abundant fresh air and nourishment, with attention to the child's general condition, may possibly defer the fatal issue.

Tuberculosis in the Tonsils and Naso-Pharynx.

Tuberculosis of the upper deep cervical glands very often develops from a primary lesion in the tonsils, or in the lymphatic tissue of the naso-pharynx; but this lesion may be so small that its presence can only be demonstrated by the microscope or by inoculation experiments. It is generally found under the epithelium near the opening of the lacunæ. In Edinburgh this form of tuberculosis is probably more commonly due to drinking tuberculous milk than to the inhalation of phthisical sputum.[1]

[1] A. P. Mitchell, *Journ. Path. and Bacteriol.*, 1917, xxi., 248.

Occasionally when there is no tuberculous lesion in the tissue of the tonsil, bovine or human bacilli are found free in the crypts.

These facts emphasize the necessity of boiling the milk when the supply is untrustworthy, and they also show the desirability of always having the tonsils and adenoids removed in cases of tuberculosis in the cervical glands.

Tuberculous Adenitis of the Cervical Glands.

Owing to the large amount of lymphatic tissue which they drain, the cervical are much more often affected than any of the other lymphatic glands; and their affection is commonest during the second, third, and fourth years of life, at which time this tissue is particularly active. They are also, however, frequently affected during the first year and in later childhood. The infection, in Edinburgh at least, is much oftener bovine than human—Mitchell found the bovine type of bacillus in 90 per cent. of his cases.[1] The glands are infected through the tonsils, or through the other lymphatic structures in the naso-pharynx, although, as mentioned above, the lesions in these situations may be so slight and transient that it may not always be possible to discover them.

Many, but by no means all, of the children who suffer from tuberculous cervical glands have a family history of tuberculosis, or have had their resistance lowered by a recent attack of some weakening disease.

Pathology.—The bacilli may be carried by the lymphatics to the periphery of the glands; or, as happens more frequently, by the blood-stream, into their centre. As the disease spreads outwards, periadenitis develops, and the glands become matted together. Finally, rupture may take place into the surrounding tissues, so that a cold abscess forms and works its way outwards, ultimately destroying the skin and causing a sinus which becomes the seat of a mixed infection. During this process, adhesions take place to the adjacent muscles, to the sheath of the internal jugular, and, much less commonly, to the vein itself. The glands most frequently affected are the anterior deep cervical, or tonsillar group, the submaxillary (much less commonly), and the posterior or sterno-mastoid glands. The

[1] A. P. Mitchell, *Edin. Med. Journ.*, Sept. 1914, xiii., 200; John Fraser, *Clin. Journ.*, 10th and 17th Feb. 1915, xliv., 41 and 49.

last-named group may be infected secondarily from the tonsillar glands, or primarily from the fauces and naso-pharynx.

Clinical Features.—The general symptoms of tuberculous adenitis are usually few and indefinite; but, in some cases, the attack begins as an acute tonsillitis with an evening rise of temperature. At first, the enlarged glands are discrete and painless; then they become matted together; and ultimately a local softening occurs, with or without tenderness, which ends in reddening and thinning of the infected skin. When a sinus forms, the surrounding skin often ulcerates.

Diagnosis.—The trivial nature of the general symptoms, the absence of marked local tenderness, the hardness of those glands which have caseated, and the formation of cold abscesses containing no pathogenic organisms, are all characteristic of tuberculous gland disease. The absence of obvious local lesions in the scalp, mouth, tonsils, and naso-pharynx, sufficient to account for the glandular enlargement, is also in favour of this diagnosis. An acute onset of the glandular swelling is not against the diagnosis of tuberculosis, but it is a favourable sign if the glandular swelling subsides rapidly under the use of boric fomentations. In Hodgkin's disease, the glands are very large, numerous, and discrete, and they show no softening.

Prognosis.—The condition is generally merely a local one; for it is rare to find tuberculosis of the cervical glands spreading to internal organs. When the disease does extend rapidly from one group of lymphatic glands to another, it is a bad sign, as it shows a low power of resistance.

Treatment.—Rest in the open-air and sunshine, and nourishing diet, are important in these cases. Exposure to the X-Rays for five to ten minutes at a time, every ten days or so, has been strongly recommended; and tuberculin injections seem in some cases to do good, though they are often unsuccessful.

In the vast majority of cases, tuberculous glands in the neck are best treated by excision.[1] There are some cases, however, in which operation is not desirable. This is so in young infants with very extensive disease who are judged to be unable to stand the operation; also in cases in which the disease is so widespread that no complete operation is possible; and in those in which there are numerous sinuses and much periadenitis.

[1] H. J. Stiles, *Trans. XVIIth Internat. Congr. Med.*, London, 1913, Sect. x. (*Dis. of Child.*), 78.

In cases of a mild type in which the glands show no signs of caseation or abscess-formation, operation is sometimes unnecessary. Before the operation, if periadenitis is present, it is always advisable to treat this by the use of boric fomentations; and it is also well that the condition of the mouth, naso-pharynx, and throat should be seen to. In cases of very young children in whom the disease was so extensive that no surgeon would operate on them, I have more than once known complete recovery to take place, as the result of very prolonged and thorough open-air treatment along with feeding up, with fixation of the head and neck by a Treves' splint or other similar apparatus, and with attention to the mouth and throat.

Tuberculosis of the Bones and Joints.

The large majority of the cases of tuberculous disease of the bones and joints met with in Edinburgh are due to the bovine type of bacillus (62 per cent.[1]), and are therefore presumably caused by the use of tuberculous milk. The infection is carried in the blood from its site of entrance to the synovial membranes and bones. Healthy joints are readily affected in this way, but healthy bones do not take the infection, because they are naturally very resistant to the tubercle bacillus. This insusceptibility, however, is rapidly destroyed if the child is suffering from tuberculous disease elsewhere, for tuberculous toxin circulating in the blood sets up endarteritis in the blood-vessels which supply the bones, and the resulting gelatinous or myxo-fibromatous degeneration of the marrow lowers its resistance so that tuberculous osteomyelitis readily develops.

Pathology.—The disease in the bone may begin in the diaphysis, the articular end, the metaphysis,[2] or the epiphysis. A history of some injury, usually a trivial one, is often given; and what probably occurs in these cases is that a small vessel, the walls of which have been weakened by endarteritis, is ruptured and extravasation takes place. The tubercle bacilli in the extravasated blood proceed at once to form tuberculous follicles; and,

[1] John Fraser, *Journ. of Amer. Med. Assoc.*, 2nd Jan. 1915, lxiv., 17; and especially *Tuberculosis of the Bones and Joints in Children*, London, 1914, (A. & C. Black), 6.

[2] "Metaphysis" is a term recently applied to that portion of the bone which lies immediately upon the diaphysial side of the epiphysial cartilage.

before long, caseation has begun in the centre of the mass, and fibrosis at its periphery. If the caseation predominates, the disease tends to spread rapidly (infiltrating tubercle); while, if there is much fibrosis, the disease remains localised (encysted tubercle). An injury to a bone in which there is encysted tubercle may lead to the development of the infiltrating type.

The very important subject of bone-tuberculosis need not be further considered here, as it pertains to surgery,[1] but references to various aspects of it, such as tuberculous disease of the cranial vault (p. 63) and of the mastoid and petrous bones (p. 794), to tuberculous dactylitis (p. 84), and to paralysis due to spinal caries (p. 608), will be found elsewhere.

Abdominal Tuberculosis.

In this country the abdominal cavity is a very frequent site of tuberculous lesions in young children after the first year of life. Indeed an examination of hospital statistics seems to prove that the disease is more prevalent in Edinburgh and Glasgow than in any other cities in the world.[2] This is owing to the defective supervision and control of their milk-supply, and to the frequency with which the milk used for infant-feeding is not efficiently sterilised.

It is not common, however, in children to find the tuberculous lesions confined to the abdomen. In most instances other old foci of disease exist in the thorax or elsewhere. It is also noticeable that in early life tuberculous lesions tend to spread rapidly to neighbouring parts, so that it is comparatively rare to find a pure case of peritoneal, intestinal, or mesenteric gland affection. Usually the disease in these different situations is only part of a more or less generalised infection. It is well, therefore, to regard tuberculous peritonitis, tuberculous mesenteric gland disease (*tabes mesenterica*), and tuberculous ulceration of the bowel as merely different manifestations or

[1] For a very full and practical account of the pathology, diagnosis, and treatment of all varieties of tuberculous bone and joint disease, see John Fraser, *Tuberculosis of the Bones and Joints in Children*, London (A. & C. Black), 1914.

[2] J. Thomson and A. Dingwall-Fordyce, "On the Relative Prevalence of Abdominal and Meningeal Tuberculosis in Children in Different Countries," *Tuberculosis in Infancy and Childhood*, edited by T. N. Kelynack, London, 1908, 115.

phases of abdominal tuberculosis rather than to describe them as separate diseases.

Abdominal tuberculosis, then, takes various clinical forms, the chief of which may be enumerated as follows :—

1. *Ascites*, in which the eruption of tubercles on the peritoneum is accompanied by the effusion of fluid either into the general peritoneal cavity or into a part of it shut off by adhesions. Tuberculous peritonitis is far the commonest cause of ascites in children.

2. *Adhesive peritonitis*, in which there is more or less general glueing together of the intestinal coils, with or without suppuration or the formation of caseous plates.

3. *Cases with symptoms of acute peritonitis.*—In some of these, there is merely an unusually acute tuberculous inflammation of the peritoneum. In others, the acute symptoms are caused by the rupture of tuberculous glands or ulcers with secondary infection by other organisms.

4. *Caseous mesenteric glands* (*tabes mesenterica*).—Often these give rise to no local symptoms.

5. *Tuberculous ulceration of the bowel* may occasion obstinate diarrhœa, but its symptoms may be very indefinite. Generally the mesenteric glands are severely affected.

6. *Stenosis and obstruction of the bowels*, as the result of tuberculous ulceration or adhesions, is occasionally met with, and is very important to recognise with a view to its relief by surgical operation.

7. *Latent cases.*—It is not uncommon to meet with cases in which abdominal tuberculosis has run its course in so insidious a way that no illness has been suspected, until an abdominal operation or a post-mortem examination reveals the presence of peritoneal adhesions, cicatrised ulcers, or caseous glands.

Symptoms.—These vary according to the parts first and most severely affected. In the great majority of cases, however, the onset is insidious, and the first symptoms slight and equivocal. The child is noticed to be getting thinner and paler and weaker, while his abdomen is steadily enlarging. The tongue is often quite clean. The appetite is small or capricious. The motions may be very unhealthy in character, and often there is alternate diarrhœa and constipation. Sometimes there are recurrent attacks of colic, but often none are complained of. The temperature may be normal, but it is often raised

in the evening; and there may also be profuse evening perspirations.

Physical Signs.—The condition of the abdomen varies considerably in different cases and at different stages in the same case. When free fluid is present to any extent, the usual signs of ascites are easily made out, and in many cases nothing else can be discovered. In cases with much adhesion of the intestine, especially in young infants, extreme tympanites is not uncommonly found, and it may resist all attempts at treatment by diet or drugs. Sometimes all that can be felt is a peculiar sense of resistance, along with gurgling in many cases. This is due to the coils of intestine not moving on one another as in a normal abdomen. Sometimes flat caseous masses, with either sharp or rounded edges, are easily felt just below the parietal peritoneum, or in the omentum. When suppuration takes place there is often, sooner or later, a rise of temperature, and the abdomen may become tender. In time, the umbilicus and its neighbourhood become reddened and prominent; and, later, the pus makes its way to the surface in this situation.

FIG. 246.—Abdominal Tuberculosis with Intestinal Stenosis. Boy of 2 years.

Caseous glands if numerous often form large hard masses which are easily palpated. If the abdominal muscles are rigid, however, even large glandular swellings may escape detection unless an anæsthetic is administered. A rectal and bi-manual examination is generally advisable. Occasionally an abscess connected with a gland, or with an intestinal ulcer, bursts into the peritoneal cavity. When this occurs, symptoms of acute peritonitis are set up and the case may be indistinguishable from one of appendicitis or septic peritonitis. In extensive ulceration of the bowel there may be considerable rigidity and tenderness of the abdominal muscles.

Stenosis of the bowel leads to distension of the portion of intestine above the obstruction with hypertrophy of its walls.

When this occurs, there are often recurrent attacks of severe abdominal pain. During these, the coils of hypertrophied and dilated bowel stand out prominently on the surface of the abdomen, and its peristalsis is very noticeable (Fig. 246). Loud gurgling may also be heard. These symptoms are characteristic and should not be overlooked, as they indicate a serious condition which requires a surgical operation for its relief. In sub-acute and chronic cases of abdominal tuberculosis there is not infrequently tuberculous affection of the testicle and spermatic cord.

A type of case often occurs in well-nourished, previously healthy children which is apt to pass unrecognised. In this, feverish attacks of a remittent type lasting two or three weeks recur at intervals of a few months. No other distinctive symptoms are present beyond abdominal distension, and the first attack, at least, is apt to be diagnosed as a mild case of enteric. The real nature of the illness becomes evident later when it has occurred more than once. In each of these attacks there is probably a fresh, but limited, eruption of tubercles on the peritoneum, and, as the symptoms subside, an area of new adhesions is left which, in time, leads to the characteristic sensation on palpation. These cases, when early and energetically treated, generally recover most satisfactorily and permanently.

Diagnosis.—In most cases this is easy, except in the early stages. Suspicions of the tuberculous nature of the case are strongly confirmed if the lungs are found to be also affected; likewise, if the patient has been drinking unboiled milk, if there is a distinct family history of tuberculosis, or if a phthisical person has been associating much with the child. The obstinate continuance of diarrhœa in a young child in spite of careful treatment, along with a hectic temperature, may arouse suspicions of tuberculous disease but does not prove it. There are no special features characteristic of tuberculous diarrhœa that can be easily recognised.

Prognosis.—When the abdominal condition is not complicated by the presence of severe tuberculosis elsewhere, when it is not in an advanced stage, and when there is no previous cachexia, the chance of recovery under proper treatment is very considerable. Thoroughly energetic treatment, begun fairly early and consistently persevered in, is often

surprisingly successful. I have seen a considerable number of cases in which large hard masses of tuberculous glands entirely disappeared after months, or perhaps years, of careful treatment, so that even under chloroform they could not be felt. Recovery, indeed, need scarcely ever be despaired of, except in very advanced and cachectic cases in young infants. As a rule, it may be said that the older the child is the better is the prognosis.

Treatment.—In this, as in most other forms of tuberculosis in children, if we are to get the best results there must be what Osler calls "masterful management" of the case in the early stages. Thorough-going and intelligent open-air treatment must be insisted on, and no half-measures allowed. So long as there are any acute symptoms, the patient is better in bed, but his bed should be where it can be lifted easily out into the sunshine.

In addition to open-air treatment, every possible means must be used to increase the child's nutrition without disturbing his digestion or irritating his bowels. All indigestible articles must, of course, be forbidden. Starchy foods have to be given in strict moderation. The more milk and cream the child can digest the better, but the milk should be peptonised, and the amount carefully restricted, if there is flatulent distension, or if curds appear in the motions. Minced underdone meat, raw-meat pulp, raw-meat juice, eggs in various forms, fish, plasmon, and somatose, are of great value in the diet. When the appetite is not good, alcohol is often beneficial, and either brandy and egg mixture or port wine may be given with advantage.

Cod-liver oil, iron, creasote, and arsenic are all useful at times, provided they can be given without upsetting the digestion or lessening the appetite. The application to the surface of the abdomen of iodoform ointment (10 per cent.) or of mercurial ointment seems certainly to do good in some cases. If there is much pain, extract of belladonna in glycerine (1 to 4) may be applied on lint. Should the fluid in an ascitic case increase so as to embarrass the breathing, or should it remain for more than a fortnight without diminishing, it is generally advisable to draw it off with a Southey's tube or small trocar, unless a surgical operation has been determined on. Injections of tuberculin are sometimes useful.

On the place of surgery in the treatment of this disease there is still considerable difference of opinion. All are agreed that an operation may be necessary when abscesses form, or when stenosis is present to an extreme degree. It is also generally held that when the peritoneal cavity is to a large extent obliterated by adhesions, surgical operation is dangerous and not likely to benefit in most cases. The removal of tuberculous mesenteric glands is very rarely possible or advisable. When suppuration occurs, the abscess, which always tends to point at the umbilicus, should be allowed to evacuate itself spontaneously; or at least it should not be incised, until the reddened skin over it is on the point of giving way. Any attempt to open the abscess while it is still deeply situated is inadvisable, because of the great risk there is of rupturing the diseased and adherent bowel.

The chief difference of opinion refers to those cases in which the peritoneum, though studded with tubercle, is not yet firmly adherent, and especially to cases of tuberculous ascites. Some years ago a simple free incision into the peritoneal cavity, with evacuation of any fluid it might contain, was regarded as greatly increasing the child's chance of life. Many cases have certainly made a satisfactory recovery after this simple operation. There has, however, always been difficulty in determining to what extent the improvement was attributable to the surgical proceeding, because the type of case which does best after it is exactly that which most often recovers under purely medical treatment. In recent years several competent observers[1] have expressed strong doubts as to whether the opening of the peritoneum does any good whatever, and have suggested that it is in spite, rather than because, of the operation that the children recover.

My own belief is that formerly too much was expected from laparotomy in tuberculous ascites, but that it is, nevertheless, decidedly beneficial in suitable cases. When thorough medical treatment, energetically carried out, has failed to arrest the symptoms, and the disease is showing no signs of abating, rapid and continued improvement often follows

[1] J. Comby, *Rev. de Méd. des Enf.*, 1902, v., 577; Leonard Guthrie, *Rep. of the Soc. for the Study of Disease in Children*, 1903, iii., 117; G. A. Sutherland, *ibid.*, 111.

incision, especially in older children and adolescents; and the risk of the operation is exceedingly small. The number of young infants benefited by laparotomy is much smaller and the risk in them is much greater. Implication of the pleura and even a slight lung affection are not contra-indications to operation. Whatever the explanation may be, it is, I think, the general experience, as well as my own, that the results of removing the tuberculous ascitic fluid with a trocar and canula are not nearly so good as those of simple incision.

When there are clear indications of intestinal obstruction from stenosis or compression of the bowel, a surgical operation is urgently called for, as has been already mentioned.

Thoracic Tuberculosis.

In children as in adults, the chest is an exceedingly common site of tuberculosis; and both acute and chronic forms of the disease may affect the bronchi, the lungs, and the pleuræ. Owing to the extreme activity and vulnerability of the lymphatic structures in young children, however, it is in the bronchial glands, and not in those other organs that the commonest lesions, and those most characteristic of tuberculous disease in early life, are to be found.

Tuberculous Bronchitis.

In childhood the larynx is rarely affected, but tuberculous bronchitis is an extremely common and important disease, although a large proportion of the cases cannot be diagnosed. In taking the histories of all sorts of tuberculous cases we often get an account of previous slight attacks of bronchitis which have usually been thought of no importance. These, however, have been the earliest clinical manifestation of the tuberculous infection; and had they been energetically treated, later serious forms of the disease might in all probability have been prevented.

The symptoms of tuberculous bronchitis differ in no way from those of an ordinary attack of bronchial catarrh; and the cases can only be positively diagnosed, at the time of their occurrence, if tubercle bacilli are found in the sputum. A decided reaction with a tuberculin test, or a history of the child having been closely associated with a phthisical adult,

should always arouse a suspicion that the bronchial affection is of a tuberculous nature.

Treatment.—It is wise to treat energetically all such cases of bronchitis as if they were tuberculous, and to subject them to a thorough course of open-air treatment and extra-feeding.

Acute General Miliary Tuberculosis of the Lungs.

The symptoms in the early stages of acute general miliary tuberculosis of the lungs are often very perplexing, as they

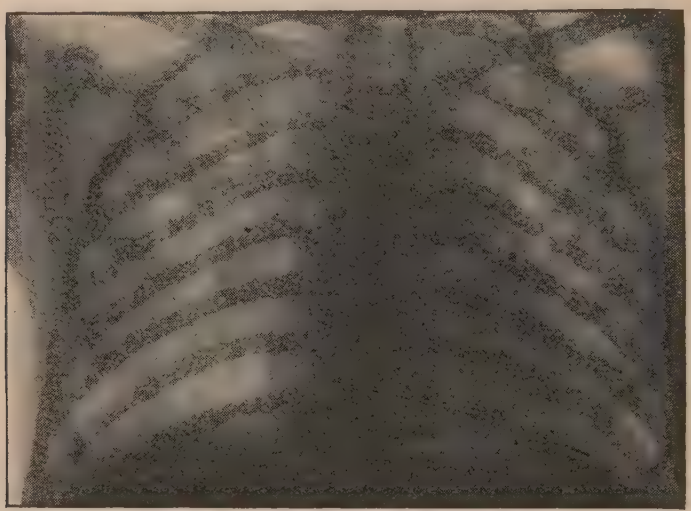


FIG. 247.—Skiagram of Thorax. Disseminated pulmonary tuberculosis and enlarged bronchial glands. Girl of 11 years. (Dr J. S. Fowler's case.)

differ very little from those of influenza or acute bronchitis. After a time, however, our suspicions are aroused by their persistence, and by their getting steadily worse in spite of all treatment. The respiration becomes more rapid and the child more and more breathless on slight exertion; the cough is more distressing, and the lips and face more definitely cyanosed; the temperature also takes a higher level, sometimes reaching 101° or even 103°, and assuming an irregularly remittent type; and the spleen is usually found to be enlarging. Generally there is little emaciation. The diagnosis at this stage is often obscure, but it may be confirmed by the discovery of tubercles in the choroid on ophthalmoscopic examination; and, on X-ray

examination of the chest, a general mottling of the lungs may be seen due to the presence of numerous small tuberculous deposits (Figs. 247 and 248). Even when these show very clearly, and the lungs, as post-mortem examinations prove, are studded with innumerable tubercles, there may, for some time, be no definite physical signs discoverable by auscultation or percussion, and there is no sputum. The severity and steady advance of the general symptoms in spite of treatment, along with the trivial nature of the physical signs, form a combination

FIG. 248.—Skiagram of Thorax. Disseminated pulmonary tuberculosis. Girl of $2\frac{9}{12}$ years. (Dr J. S. Fowler's case.)

which is very characteristic of this form of the disease. The child generally dies in from six to eight weeks in a state of exhaustion. Signs of consolidation usually appear before death; and occasionally the case ends with symptoms of tuberculous meningitis.

Tuberculous Broncho-Pneumonia.

Tuberculous broncho-pneumonia is the commonest form of pulmonary tuberculosis in young children. In some of the cases in which it occurs there have been no previous chest-attacks, but in many there is a history of the former occurrence

of bronchitis or broncho-pneumonia; and not infrequently the disease has set in during, or immediately after, an infectious illness such as measles, whooping-cough, or influenza. The lung may be primarily affected, but in the majority of cases the broncho-pneumonia is secondary to disease of the bronchial glands. The onset of the disease may be very rapid, and it may only last a week or two; but usually the course is rather sub-acute than acute, lasting from six weeks to several months. Both lungs are generally affected, but the characteristic caseous nodules which are scattered through the lung-tissue may be more numerous on one side. The extent of lung implicated also varies greatly. In places, the tuberculous nodules may run together so as to form large caseous areas, sometimes with cavity formation. The part of the lung adjacent to the bronchial glands is usually very early affected, and the disease spreads forward from it to the rest of the lung and pleura. The bronchial glands are always caseous, and the broncho-pneumonia is sometimes due to their softened contents having ulcerated into a bronchus, especially the right. The pleura also is nearly always implicated, and there are extensive adhesions, occasionally small localised empyemata, or more frequently collections of clear fluid.

The *symptoms* are very similar to those of ordinary broncho-pneumonia, but the onset is more insidious, and the course prolonged and irregular—periodic exacerbations being succeeded by intervals of improvement. In addition to the cough, dyspnœa, and cyanosis, which may all be absent at first, there is increasing languor, pallor, loss of appetite, and emaciation. Hæmoptysis very rarely occurs. The physical signs are also usually not pathognomonic. There is more or less dullness with bronchial breathing, fine crepitations, and later coarse moist râles; and, ultimately, indications of cavity formation. In slowly advancing cases there is often little to be made out beyond evidence of consolidation. The respiration is usually much accelerated. The temperature curve varies greatly; sometimes it resembles that of ordinary broncho-pneumonia, while in other cases it is more like that of enteric. Very often the course of the temperature is quite irregular and atypical; though the fact of the prolonged and recurrent pyrexia is suggestive of tuberculosis.

In some cases there are other tuberculous conditions present,

such as caseous mesenteric glands or ascites, and not infrequently tuberculous meningitis sets in.

The diagnosis of tuberculous broncho-pneumonia may be very difficult, if not impossible, in the early stages. There is nothing to show that the case is not one of bronchitis or ordinary broncho-pneumonia; and, even when the illness is prolonged for months and one relapse follows another, and the spleen enlarges, there may be no proof that all the symptoms are not due to chronic pneumococcal infection.

Pulmonary Phthisis.

Pulmonary phthisis proper, apart from tuberculous broncho-pneumonia, from miliary tuberculosis of the lungs, and from bronchial gland disease, is a comparatively rare affection in young children. It may, however, occur at any age. When met with in babies, its chief peculiarities are that it begins more frequently in the lower lobe and root of the lung than in the upper lobe, that the patients are feeble and cachectic, and that the progress of the disease is very rapid. The children most often affected by phthisis are those over ten or twelve years. Their symptoms resemble those in adults, but the prognosis is generally very unfavourable; for the fact that the lung has become affected in this way is an indication that the child has less than the usual power of resistance to the tubercle bacillus.

The diagnosis of phthisis in childhood may be difficult in the early stages. The sputum is scanty and difficult to obtain, and, when obtained, often contains no tubercle bacilli, and the general symptoms are few and not characteristic. Cases of chronic pulmonary consolidation should not therefore be diagnosed off-hand as tuberculous, until some definite proof of the presence of the disease has been obtained from the examination of the sputum, the use of X-rays, or a tuberculin test, and after prolonged observation. Many children with apical dullness and other symptoms, which, if they occurred in adults, would be regarded as tolerably certain signs of phthisis, recover entirely in a few weeks under the influence of rest, fresh air, good nourishment, and nursing. Attention has been drawn already (p. 256) to the frequency with which chronic intestinal indigestion is mistaken for early phthisis on account

of the loss of weight, cough, profuse perspiration, and evening rise of temperature which it often causes; and also (p. 68) to the fact that palpable supraclavicular glands are normally present in childhood, and are not an indication of tuberculosis.

Tuberculous Pleurisy.

Tuberculous, like other forms of pleurisy, may occur with, or without serous effusion; and sometimes, though not very often, it ends in empyema. This, however, only occurs when there is also severe lung affection. The dry form of the condition varies greatly in severity in different cases. Slight passing attacks are common in children with other forms of tuberculosis, and may be the first manifestation to be recognised; though, owing to the trivial nature of their symptoms, they are apt to be overlooked. Occasionally there is much fibrinous exudation, and extensive adhesions form; and when fluid effusion takes place—either serous or purulent—it is often localised by adhesions.

The *diagnosis* in tuberculous pleurisy is often difficult, because microscopic examination of the fluid generally gives negative results, and often also its injection fails to infect guinea-pigs. A tuberculin test may frequently be useful.

The *treatment* is the same as in other forms of pleurisy; but the main thing is that its tuberculous nature should be recognised early, if possible, and the general health energetically treated by fresh air, and other measures calculated to improve the child's nutrition.

Tuberculosis of the Bronchial Glands.

Far the most important and characteristic chronic tuberculous chest-lesion in childhood consists in an infiltration of the bronchial glands, which is probably always secondary to a small temporary lesion in the lungs and bronchi. In very many instances, the disease is almost entirely confined to these glands; and, frequently, it either ends in recovery, or remains encapsuled and harmless. The process in them is similar to that already described in the cervical lymphatic glands. In some cases the glands continue to enlarge until the circulation of lymph through them is so obstructed that the infection

spreads backwards and ultimately re-infects the lung—this time to a very serious extent. Sometimes also the glands break down and discharge their contents into the bronchi. When the disease becomes arrested in the bronchial glands, it remains latent in them for many years, or even for life, unless some weakening disease, such as measles, whooping-cough, or influenza, lowers the general resistance, or a bronchial catarrh stirs up local mischief. Under such circumstances, the local lesion may revive and spread, or the blood-stream become infected and general tuberculosis or tuberculous meningitis result.

The *intrathoracic lymphatic glands* are divided into parietal and visceral. The visceral group comprises the tracheal, the tracheo-bronchial and the bifurcation glands, and those of the interbronchial or broncho-pulmonary groups. Those earliest and oftenest affected are the bifurcation glands, especially those which lie under the right bronchus. In all cases of tuberculosis, infection of these glands is extremely common. Still and J. W. Carr (London) both found them caseous in four-fifths of their post-mortems on tuberculous children; and Hamburger, in Vienna, only found them unaffected in one case out of eighty-six.

Clinical Manifestations.—The indications of the presence of tuberculosis of the bronchial glands are very vague and equivocal in the early stages. There is usually wasting, pallor, loss of appetite and vigour, hoarseness, cough—often slight and occasional, but sometimes severe and paroxysmal—some chest-pain on deep breathing, night-sweats, and fever; but, not infrequently, the general health is curiously little affected. In young infants a low-pitched grunting sound with expiration is sometimes caused, which may be mistaken for that produced by adenoids or even for congenital laryngeal stridor.

The **physical examination of the chest** for enlarged bronchial glands often yields very indefinite results. Occasionally, when the enlargement is considerable, there may be a distinct extension of dullness to one or other side of the manubrium sterni which may lead to a mistaken diagnosis of apical consolidation. A fullness of the veins on the surface of the chest is also seen in some cases. *D'Espine's sign*[1] has

[1] *Bull. de l'Acad. de Méd.*, Paris, 1907, Ser. 3, lvii., 167; *Brit. Med. Journ.*, 1910, ii., 1136.

been strongly recommended by many, but I have not had much experience of it. It may be described as follows:—

In normal children on auscultating over the spine from above downwards while the patient is speaking, the tracheal sound of the voice is found to cease abruptly at a point between the 7th cervical and 1st dorsal spines. When the bronchial glands are enlarged, however, this change does not take place at this point, but the voice alters in quality and becomes whispering in character, over the upper dorsal spines, in slight cases, and bronchophonic, in severe ones. This change may be audible over the first two or three dorsal spines, or, if the glandular enlargement is very great, as low as the fourth or fifth. The sign is most obvious when the child speaks in a low voice, and, if he cannot be induced to speak, a bronchial quality of the breathing at the same place may be heard, and has the same diagnostic significance. If the bronchial breathing is distinct, it indicates considerable and extensive glandular enlargement. In young children who will not speak, a corresponding alteration in the cry can sometimes be made out. The presence of D'Espine's sign is said to be an important indication of enlargement of the bronchial glands; but J. L. Morse's observations[1] seem to show that in about half of the cases in which it is found, the enlargement is not tuberculous in nature. The sign is commonly found in cases of asthma with chronic bronchitis, and in children with enlarged tonsils and recurrent bronchitis.

In some cases of bronchial gland enlargement, there is evidence of local collapse of the lung from pressure of the large glands on a bronchus. Sometimes also bronchitic sounds are heard, which may possibly be due to interference with the circulation in the bronchial mucous membrane by similar pressure.

An X-ray examination of the chest should always be made if possible. It is very helpful when the enlarged glands are caseous (Fig. 247).

Even in severe cases, an examination of the sputum for tubercle bacilli is often negative. The indications for *treatment* are the same as those in tuberculous gland disease in other situations.

[1] *Amer. Journ. Dis. Child.*, April 1916, 11, 276.

Tuberculous Skin Lesions.

The diseases of the skin due to tuberculosis include lupus vulgaris, scrofuloderma, and Bazin's disease, which are all caused by the local presence of the tubercle bacillus; and there are also eruptions such as lichen scrofulosorum and other "toxi-tuberculides" which are set up by tuberculous toxin circulating in the blood.

Lupus is the commonest tuberculous skin-affection, and generally begins in childhood. It is often due to direct infection from kissing by a phthisical person, or from scratching with infected fingers; consequently it is frequently found on the face. When multiple patches appear after an attack of measles (Adamson) it may be due to the spread of the bacilli in the blood-stream from a breaking-down focus elsewhere in the body. The characteristic brownish-yellow, semi-transparent "apple-jelly" nodules are often easily seen; but sometimes their characters are masked by yellow crusts, from pyogenic infection of the surface; and after a time the patch ulcerates.

Small patches of lupus are probably best treated by free excision, when this is practicable, or by the use of the sharp spoon or thermocautery. To larger areas, which cannot be so dealt with, an ointment of salicylic acid (10 grs. to 1 oz.) or oleate of mercury (5 grs. to 1 oz.) may be applied. In very chronic cases counter-irritation is sometimes beneficial. The treatment of severe and extensive lupus is generally a matter for the dermatologist. The Finsen method, the X-rays, and radium have all given good results in skilled hands. Norman Walker has seen great benefit from the careful application of a 5 per cent. ointment of old tuberculin. Active general treatment of the tuberculous condition must not be neglected.

Lichen scrofulosorum is sometimes useful in drawing attention to the presence of obscure tuberculous lesions of the internal organs. Dr Cranston Low tells me that its appearance is rather a good sign, for it is commoner in mild than in severe tuberculosis and is never seen in rapidly fatal and advancing cases. In addition to general treatment the skin should be soaked with cod-liver oil.

Tuberculosis of the Ear.

In school children aural tuberculosis is a rare disease, but in infants it is common in those places where the milk supply is contaminated by tubercle bacilli. Thus, Logan Turner and J. S. Fraser[1] found that of the hospital cases of ear-discharge under five years old examined in the Edinburgh Royal Infirmary, 9 per cent. were tuberculous; while, among those under twelve months, no fewer than 50 per cent. were due to this cause.

The disease begins in the tympanum; and it may get there either by direct spread along the mucous membrane from the naso-pharynx, or by the bacilli being carried to it through the lumen of the infant's short and wide Eustachian tube. It is probable that primary infection of the temporal bone through the blood-stream rarely, if ever, occurs. The middle ear, when once infected, becomes rapidly disorganised; the drum is destroyed, the ossicles exfoliate, and the petrous and mastoid bones become necrosed; the facial nerve is often also implicated. At the same time, the periotic glands almost always become enlarged and caseous, and often break down and form abscesses. Occasionally the disease extends directly so as to set up meningitis.

In the large majority of cases, the subjective symptoms are few and trivial, and neither pain, restlessness, nor fever is noticed; so that the first thing to draw attention to the ear is the profuse discharge of thin curdy pus from the meatus, with enlargement of glands and perhaps facial palsy.

The *treatment* consists in early opening of the mastoid antrum, the removal of sequestra, and the establishment of free drainage from the affected cavities, along with removal of caseous glands. The operation must be followed by vigorous general treatment; and a vaccine for pyogenic organisms is sometimes also beneficial.

The prognosis is not favourable. The operation though occasionally successful, often fails to eradicate the disease; and the risk of its spread to the meninges is considerable.

[1] Logan Turner and J. S. Fraser, "Tuberculosis of the Middle-Ear Cleft in Children," *Journ. of Laryngology, Rhinology, and Otology*, June 1915, 209.

CHAPTER XXXVIII

ON NURSERY HYGIENE

Clothing.

THE details—even the minute details—of a child's clothing are well worthy of attention. The main principles which should regulate them may therefore be briefly referred to.

General Principles.—A child's clothing should be uniformly warm, soft, and light. It should also be moderately loose, so that it does not exert undue pressure on any part of the body and can be quickly put off and on.

The clothes must be sufficiently **warm** not only because this is necessary in order to prevent chills but because, if the body is not adequately protected, it has to waste more nerve energy in heat production than it can fairly afford. Children's heat-producing powers are feebler than those of adults; sufficient clothing is therefore especially important for them. Any attempt at hardening a child, as it is called, by under-clothing him, is to be regarded as even more foolish than over-heating him by too many or too thick clothes.

It is also extremely important that, in little children, the protection from cold provided by the clothing should be uniform. Many recurrent catarrhs of the respiratory and digestive tracts, in cold weather, are due to bare arms and legs and scantily covered bodies. Long sleeves and stockings and a knitted or flannel binder are very effective in warding off such attacks.

When a child exposes himself to the risk of chills by constantly kicking off the bed-clothes, it is a good plan to give him a long bed-gown the lower end of which is fitted with a string like the mouth of a bag, so that when it is drawn tight he cannot get his legs out.

Paralysed limbs especially should be well covered, both in the daytime and at night. Warmth favours the circulation in them and probably lessens the often inevitable atrophy. Should ordinary thick or double stockings or sleeves not be sufficient, it is well to have them padded with cotton-wool.

The baby's clothes should be **soft**, **light**, and **loose**, because his skin is soft and tender and easily chafed, and his movements are readily hampered by slight restraint. Constriction of any part of the body or limbs is prejudicial to normal growth and development.

Lastly, little children ought to have their dress so arranged that it can be **put on and off** as **quickly** as possible. This is very important in the case of feeble and sick infants, who may suffer seriously if they are wearied, irritated, and chilled, by an unnecessarily complicated process of dressing and undressing. In all serious illnesses it is advisable to discard ordinary clothes with their numerous buttons, tapes, and bands and to substitute for them simple flannel night-clothes lined with thick layers of cotton-wool.

When we come to apply these elementary principles, we find that woollen garments of loose texture (*e.g.* knitted ones) are the best for a child to wear, especially next the skin. Wool is a bad conductor of heat, but is easily permeable so that it does not interfere with the free evaporation of moisture from the skin. The only exception to this is in the case of the napkins which babies have to wear until they gain some measure of control over the bladder. These are generally made of linen or cotton, because they have to be frequently washed. Occasionally we find a mackintosh worn over the napkin to save trouble. This may be allowable under special circumstances, as on a journey, but when used habitually it is most objectionable, as it is sure to cause irritation of the skin. When soda, or strongly alkaline soap, is used in washing the napkins, there is also a risk of skin irritation (p. 332).

When, in cases of diarrhœa, there is much redness of the parts surrounding the anus caused by irritating fæces, it is sometimes a good plan to place a large pad of absorbent cotton-wool inside the diaper. This absorbs the liquid fæces in such a way as to prevent their coming in contact with so

large an area of skin as is the case when the motion spreads itself out over the napkin.

The child's bed-clothes should not be so thick and heavy as to overheat him, but they require to be a little warmer than those he wears during the day, to make up for the want of exercise while sleeping.

Fresh Air and Sunshine.

Fresh pure air, cleanliness, and warmth are absolutely necessary for perfect health, and sunshine is especially important. Children, like flowers, get pale and droop without the sun. The nursery should therefore be the sunniest, driest, freshest room in the house. It should have a southern exposure, be well ventilated, and kept at a temperature of 60° to 65° F. The windows should be widely opened several times during the day to air the room thoroughly, and one window at least should be constantly open for some inches at the top.

The children of many of the respectable poor are less robust than those of their more careless neighbours, just because of the care with which they are protected from cold and at the same time from fresh air. This injudicious keeping in a close atmosphere is especially dangerous during convalescence from such diseases as measles and whooping-cough. At such a time it may make all the difference between complete recovery and the development of tuberculosis.

Draughts.—While seeing carefully to the ventilation, however, we must, in some forms of illness, be careful to avoid draughts. For healthy children, the risk of injury from draughts is much less than that from deficient ventilation; but for those who are liable to recurrent bronchitis or rheumatism, the danger is a real and important one. It is well to remember that in cold weather large plate glass windows cause a constant draught in their immediate vicinity.

Going out.—As a general rule, a baby should be taken out every fine day, summer and winter. If he is born in summer, he may go out for the first time about a fortnight after birth; if in winter, not for a month or six weeks—

and then only if the weather is fine. At first he should not be out longer than from fifteen to twenty minutes, but later, if the weather is warm and dry, he can scarcely be too much in the open air. It is important not to allow young or delicate children to be exposed to windy weather, even although the thermometer is not very low, because they are readily chilled by wind. In the same way it is important even in this country that babies should be carefully protected from the sun in warm weather. The evaporation which takes place from wet roads is sometimes a source of chill in the case of delicate children who are old enough to walk, even although the weather overhead is not very cold.

Little children should not be taken out, even in good weather, if they are coughing and sneezing or otherwise suffering from the results of a recent chill. When, however, children who are past babyhood are in good health, it is safest in the long-run to err, if at all, in sending them out too much or in too cold weather rather than in keeping them too much shut up. If a child has a tendency to eczema, he should be carefully protected from cold winds.

The great value of open air in the treatment of broncho-pneumonia has already been referred to (p. 510).

Washing and Bathing.

A baby should have one bath every day, and if he is strong he may have two. Harm is certainly often done by bathing delicate children too much. For babies who are not strong, one regular bath, and sponging in place of a second, is much better than two baths.

The temperature of the bath should be about 90° F. in the case of young babies, and if they are delicate, it is always well to use a bath thermometer. The water should never be warmer than 95° F. As the baby grows older the bath, especially in warm weather, may be reduced to 85° or even 80°.

Very little soap is required for the general surface of the body in a young infant, and soaps containing much free alkali are especially to be avoided. For children with delicate skins, some form of overfatty soap is desirable; but

for ordinary healthy children, plain unscented soap does quite well.

The bath should be given in a part of the room where there is no draught, and the baby should not be in it more than five minutes. The drying process after it must be rapid and thorough. It is customary after drying the baby to apply some soothing powder to those parts where folds of skin are in apposition. For this, oxide of zinc, starch and boracic powder, or plain fuller's earth may be used. Should there be any tendency to intertrigo, some simple ointment such as zinc ointment, cold cream, or vaseline is better.

If a baby's skin and nails turn blue and his nose and limbs get very cold after the bath, and it seems to weaken and depress him, it may be necessary to stop the bath and only to have him sponged instead, as much as is necessary for cleanliness.

The Cold Douche.—Ordinary cold douches are very good for many older children, but for the little ones in the nursery, and those who are delicate among the older children, they should only be given in modified forms and always with caution and attention to details.

The best way to give a cold douche to little children is, after they have been washed in warm water and are still sitting in it, to pour some cold water from a big sponge or from a jug over their shoulders and to take them out at once and dry them thoroughly.

When a cold douche is to be given to a delicate child, he should always stand in a little hot water while he is having it. When this precaution is taken, the bath will often do good when otherwise it would not have done so. Care should also be taken that the room is warm and that the child is not allowed to chill himself before the bath begins by hanging about or playing without sufficient clothes on. *Disregard of precautions in such matters often results in recurrent ailments which are attributed to special delicacy.* It is a good plan to have the child shampooed thoroughly all over for five or ten minutes before the bath, and energetic friction with a rough towel after it, is stimulating and beneficial.

Uses of the Cold Douche.—Cold douching carefully carried out is extremely useful for many children. It stimulates the

nervous system, improves the circulation, and often does away with the coldness of the feet which is such a troublesome symptom. The appetite also increases under its use, and the children become altogether healthier and happier and are less liable to take cold.

Modification of Cold Douche.—Sometimes the cold douche disagrees with the child and causes unpleasant symptoms. For example, instead of its leaving him with a healthy glow and an increased appetite and generally brightened up, he may be pale and shivery after it, with cold blue fingers and a disinclination for food; or the healthy reaction may only last a short time and be followed by weariness, headache, and a feeling of chilliness.

If a cold bath, given with all due care and precaution, results in either of these conditions, it must be modified or discontinued. Often a tepid salt water bath does very well in such cases, the salt increasing the stimulating effect of the water on the skin. Again, in children with a weak circulation, thorough rubbing of the body, with a coarse towel which has been wrung out of cold water, is an excellent substitute for a regular bath.

In other cases, the cold bathing may be limited to certain parts. Children with cold feet who cannot stand an ordinary douche may be benefited by having their feet bathed in cold water and afterwards briskly rubbed, and a similar cold sponging of the throat and shoulders is useful for diminishing the liability which some children have to take throat colds. Lastly, many children who cannot stand cold bathing in winter may benefit from it greatly during the summer months.

Hot Baths.—While cold baths may do harm sometimes, hot baths are just as likely to do so if injudiciously given. They must not be given too hot or too often (once in the week is enough), and the child should not be long in them—never more than ten minutes at most. The effect of such a hot bath is stimulating, but a long-continued one is weakening and relaxing. It is important that the child should not catch cold after the bath, hence it is better to give it just before he goes to bed.

Sea-water Baths.—Sea-water baths are good for children of all ages, but a child should not usually be allowed to bathe in the sea until he is six or eight years old, or oftener than once a day. The best time for a sea bath is three hours after a meal, but the child may go before breakfast, provided he has a

biscuit and milk before starting. The bath should never be taken immediately after a meal, and never when the child is feeling chilly or is hot and perspiring. The head should be wetted first, and the child should not, even in hot weather, be allowed to stay in longer than fifteen or twenty minutes. After the bath he should be rapidly dried and dressed, and should have a sharp walk and a biscuit or a glass of milk.

Sea-bathing should make a child hungrier and in better spirits. If he gets dull and chilly and seems out of sorts while he is having it, this indicates that it is not agreeing with him and that it should be stopped. Children who have perforation of the tympanum should not be allowed to bathe in the sea.

The Hair.—The hair should, of course, be kept very clean, but much washing, especially with soap, certainly causes dryness. In little boys with short hair, the head should be washed every day ; but in older children with long hair, once a week is enough. If, with an ordinary amount of washing, the hair gets very dry, it may be necessary to use a small amount of oily matter of some kind to replace the natural grease which washing has removed ; but, as a general rule, it is better in every way to put no pomade of any kind on the hair.

If scurf gathers on the scalp, it should be removed by washing with soap and water or by spirit of soap. A comb should not be used for this purpose, as it is apt to injure the roots of the hair. For the same reason, the brushes used for children's hair should be soft, and the teeth of the comb for ordinary use should be blunt and not too close together.

CHAPTER XXXIX

ON THERAPEUTICS

Baths and other External Applications for Therapeutic Purposes.

Cold or Tepid Sponging.—Cold sponging is very useful for reducing temperature, and should generally be tried before having recourse to stronger measures. The water may be used at 80° F., and the process should last five or ten minutes. Care must be taken that the child is not unnecessarily exposed nor his bed wetted.

The Wet Pack.—The ordinary wet pack is also of value, being easily applied and more efficacious in reducing temperature than simple cold sponging. A small sheet or large towel wrung out of cold water is rapidly folded round the child, and he is then wrapped up in a blanket. The pack may be repeated in twenty minutes unless the child is sleeping, in which case he may be left in it for an hour or more. This is useful in most general feverish conditions.

Local wet packs or wet compresses are useful in many illnesses. The application of a wet stocking round the neck is an excellent domestic remedy for a simple sore throat; and a wet compress around the abdomen at night is soothing and efficacious in some forms of indigestion with discomfort.

The Mustard Pack.—This is a useful form of external stimulant for cases of collapse or prostration. It causes less disturbance to the patient than the mustard bath. A tablespoonful of mustard is mixed with a quart of tepid water, and a towel is dipped in this and swathed round the whole body. The pack may be continued for ten or fifteen minutes, at the end of which time the body will be distinctly red. Similar applications to the chest are often useful in cases of

bronchitis and collapse. During the intervals between their application a cotton-wool jacket should be worn.

The Cold Douche. — The best method of applying the cold douche, and its stimulant value for delicate as well as for strong children, have been already discussed (p. 800).

The Cold or Tepid Bath. — A cold bath is very useful for reducing temperature in children, and their small size makes it easy of application. The patient should be put into water at about 100° F., which is then gradually cooled to about 80°, or even 75°, by adding cold water or ice. The child may be kept in the bath from five to fifteen minutes, and the state of the temperature and pulse must be closely watched all the time.

The Warm Bath.—The warm bath (90° F.) is used as a soothing application in cases of convulsions and laryngeal spasm. It is also useful as a diaphoretic, and is often given in the early stage of measles and other eruptive fevers to encourage the rash to come out more fully. The child may be kept in it from ten to twenty minutes.

The Hot Bath.—A hot bath (100° F.) is of great value as a stimulant, especially in children exhausted by severe diarrhœa and vomiting, and in those with pulmonary collapse. The child must not, however, be allowed to remain too long in the water or he will be depressed. For an infant, three minutes is long enough, and for an older child five to ten minutes. The child should be rapidly dried after the bath and put between blankets, with a hot bottle at his feet.

The Mustard Bath.—The addition of mustard to the hot bath makes it more stimulating and effectual. The proper proportion of mustard is one ounce to each gallon of hot water. The mustard is made into a paste with a little cold water and then gradually stirred into the bath, or it may be put into it in a muslin bag. The child is held in the bath till the arms of the person holding him begin to tingle. This is a useful remedy in cases of prostration and collapse of any kind—especially in young infants.

Ice Bags.—These require to be used with great care in infants, owing to the danger of depressing them too much. If the child is restless, there may be difficulty in keeping the ice bag properly applied. In many cases, however, in which this method of treatment is used the patient is too ill to move much.

An ice bag is frequently used in acute head cases, and great benefit may be derived from its use in acute pericarditis (p. 484).

Hot Fomentations. — These are made with flannel or spongio-piline, and are generally most used in chest cases. They are cleaner than poultices and require less skill for their proper application.

Poultices.—Poultices are not so much used now as they formerly were. This is partly because it is so difficult to get them properly made and applied; and their place is largely taken by hot fomentations. In many cases, however, where a child is suffering from uneasiness in the abdomen from any cause, a large poultice is very soothing and may secure a measure of relief which it would be difficult to obtain in any other way. Poultices are also very useful over the chest when there is pleuritic pain and on the loins in nephritis.

Mustard Poultices.—Mustard poultices are most valuable. For young babies, they should be made with one part of mustard to five of linseed meal. The mustard and linseed are mixed together dry in a bowl, hot (not boiling) water is then added, and the poultice is made, and applied on a handkerchief. It may be left on for six or eight hours, and should be followed by a thick layer of cotton-wool. For older children, the proportions may be one to three or four, but the poultice should not be left on longer than four hours.

Pure mustard must never be applied to an infant's skin, as it is apt to produce serious sloughing. In older children, a small mustard plaster or a piece of mustard leaf the size of a penny may often be applied to the episternal notch with great effect in cases of irritating throat coughs, such as are met with in chronic tracheitis and during the eruptive stage of measles.

Other Ways of Applying Heat. — Hot bottles are, of course, of great value in many cases where the child's vitality is lowered or his extremities chilly. A simple and useful method of applying warmth to an infant's cot by means of electric light is shown in Fig. 249.

Blisters.—In young infants blisters should scarcely ever be applied, and even in older children they must only be used with great care on account of their tendency to cause sloughing and the risk of their irritating the kidneys. It is generally

best, to begin with, to leave the blister on for one or two hours only, and if it has not risen then, to apply a poultice over the place. Blisters are sometimes useful in pericarditis with effusion and in endocarditis; also in some cerebral cases where there is an increase of fluid in the ventricles.

Bleeding.—It is generally accepted that in old times the practice of blood-letting was carried much too far, and that in children injudicious venesection or leeching is more dangerous than in adults. Certainly, however, in recent years many have gone too far in the opposite direction and have abstained from bleeding when it would have done a great deal of good. My

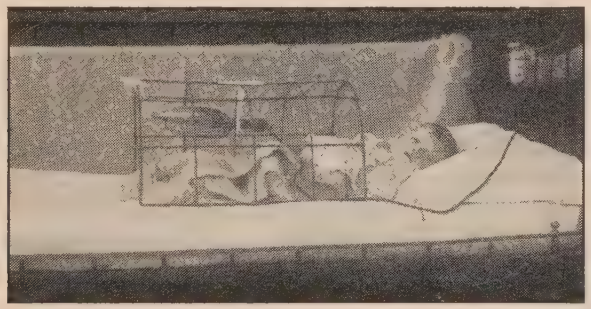


FIG. 249.—Simple method of warming bed by electricity.

own experience has been entirely in accordance with that of Dr Lees, that in suitable circumstances, bleeding "is a remedy of priceless value, capable of giving immediate relief impossible by any other means."[1]

The condition which most frequently calls for blood-letting is rapid overdistension of the right heart such as occurs in acute pericarditis, in the later stages of mitral stenosis, in acute pneumonia, and during acute exacerbations in chronic bronchitis. The chief indications are severe dyspnœa and the physical signs of a distended right auricle (p. 471). Bleeding is also of value in uræmia, and in acute meningitis and otitis in strong children.

Venesection is in some ways preferable in older children, but in infants the operation is often extremely difficult, and if

[1] D. B. Lees, *The Treatment of Some Acute Visceral Inflammations*, London, 1904, 30.

leeches can be got they are much more convenient. The best place for the application of leeches, in cases of distended right auricle, is below the right nipple. In this situation they do not interfere with the subsequent examination of the heart, and the bleeding can be arrested by pressure against the ribs. In bad cases, two leeches may be applied in the case of a baby, and from three to six in that of an older child.

Blood may also be taken in infants, from the superficial veins on the scalp or elsewhere, by means of a syringe and needle.

Dry cupping is sometimes useful in children, especially in renal cases when uræmia threatens.

Medicinal Treatment.

In the treatment of children there can be no doubt that drugs should usually occupy an altogether subordinate place. In most cases, directions as to such matters as food and drink, fresh air and exercise, clothing and rest in bed, freedom from causes of worry, and pleasant occupations, are far more valuable than any medicines. In practice these things are too apt to be taken for granted when medicine is prescribed. Not only should definite directions be given about them, but when these are important they should generally be written down. If this is not done, the details on which their efficacy largely depends are very often forgotten or misunderstood.

While the value of drugs, however, in treating children has sometimes been exaggerated, it is often also altogether underestimated. In suitable cases many medicines are of the greatest value.

Dosage.—Although Gaubius' table and other posological tables may sometimes help the beginner, their usefulness is very limited. In fixing the dose, the child's condition as to size, weight, and strength is often quite as important as his age. We have also to remember that while some drugs, such as opium, have to be given with special caution, others, like digitalis and quinine, are well borne, and one or two, such as belladonna and arsenic, can usually be taken in larger doses by children of five to ten years than by adults.

It is particularly important in dealing with children to have fluid medicines measured, if possible, in a measure glass

rather than in a teaspoon or by drops. The teaspoons in ordinary use differ considerably in size, and many of them contain 90 instead of 60 minims. The size of drops also varies greatly, not only with the nature of the fluid measured, but also with the shape of the bottle from which they are dropped.

The form of the dose is of more importance in children than in older patients. The medicine should of course be made as palatable as possible, and a large dose should not be ordered if a small one will do as well. When obstinate refusal of medicine occurs in grave illness, it is a matter for serious consideration whether the consequent struggle may not do more harm than the medicine does good.

A few remarks may be made about some of the drugs which are most useful in the treatment of children.

Alcohol.—Stimulants should never, of course, form part of a healthy child's diet, but in debility great benefit sometimes results from small doses of wine or beer or diluted brandy taken with food. Alcohol is also frequently of great use in acute disease in childhood, as in later life. In ordinary feverish illnesses, it is not required; but if there are signs of heart failure, or if a typhoid condition should set in, it may be urgently called for. It is also useful in exhausting conditions, such as the pulmonary and other complications of whooping-cough or measles, and in septicæmia.

Alcohol may be given in the form of brandy, whisky, wine, or sherry whey. When whisky or brandy is ordered for young babies, it must not be given too concentrated—not more than 15 drops to the teaspoonful; and it is always well to indicate the minimum to be given in the twenty-four hours, and the amount that is not to be exceeded. A baby of a year or two old may have from 2 drms. to ½ oz. of whisky or brandy in the twenty-four hours, and this may be increased in some cases to 1 or even 1½ oz. To a child of three or four, double this amount may be given. Small doses frequently repeated and well diluted are preferable to larger doses given at longer intervals. If the amount of the stimulant is not strictly prescribed, the patient will be liable to get either too little or too much.

Sherry whey (see Appendix J) forms a useful way of giving alcohol to young babies. The nourishment it contains, though

not large in amount, is in a very digestible form. The following analysis is given by Myers and Still[1]:—

Proteid (mostly lactalbumin)	0·45 per cent.
Fat	0·95 „
Milk sugar	5·00 „
Alcohol	2·30 „

It has a decidedly acid reaction. The alcoholic strength when made from "cooking sherry" is about one-eighteenth that of brandy. If good drinking sherry is used, a larger amount of the wine is necessary to produce coagulation and the alcoholic strength is therefore greater. Sherry whey is often retained by an irritable stomach. When there is flatulence and colic, it has often a markedly carminative effect.

Tonics.—Tonics are sometimes of great value, and their use will often speedily bring a child who has been ailing back to his normal condition. The use of some of them, however, is much restricted owing to their upsetting the digestion.

Cod-liver Oil.—Perhaps the best and most generally useful of all tonics for young children is cod-liver oil, but it should not be ordered if there are signs of dyspepsia; and, if its administration interferes with the child's appetite or digestion, it must be discontinued and an alkaline or acid tonic substituted. This often soon improves the digestion so much that the child is able to take the oil again with benefit. Those who can take cod-liver oil well in winter are often unable to digest it during hot weather. From 10 to 30 minims thrice daily is a sufficient dose for most young children, and it may either be given pure or in the form of an emulsion (Appendix I, Form. 14). If it agrees well, the dose may be increased to a teaspoonful; but if undigested oil is noticed in the motions, the dose should be diminished.

Iron.—Iron is a most useful drug in children. It has, however, to be given with caution because of the risk of its disagreeing with the digestion. A convenient form for its administration is reduced iron. Of this ½ to 1 gr. may be given to infants thrice daily, and 1 or 2 grs. to older children. It is readily taken, and has the advantage over liquid preparations that it does not discolour the teeth. When constipation is present, the sulphate may be given along with sulphate of magnesia (Appendix I, Form. 8).

[1] Myers and Still, *Lancet*, 12th Jan. 1907.

Arsenic.—Arsenic is usually given in the form of Fowler's solution. It may be given, as a tonic, in doses of 2 to 5 drops well diluted thrice daily after food; and in much larger doses, for a short time in chorea (p. 592). It is also useful in minute doses in lienteric diarrhœa and allied conditions (p. 266).

Quinine.—Quinine is one of the drugs which children bear well and can take in comparatively large doses. It is usually given in solution, 1 gr. of the sulphate to a teaspoonful, and some flavouring or sweetening substance (such as syrup of orange-peel, 20 minims to each $\frac{1}{2}$ gr.) may be added, though none of them are very successful in disguising the taste. Larger doses of the powder may be shaken up rapidly with syrup and swallowed before much has been dissolved. Probably the best way to administer it to young children is to order it suspended in glycerine (1 gr. to the drachm) and to direct the nurse to give the dose in a wineglassful of milk (E. Smith). In children over three, the sulphate may be given in the form of capsules, or it may be made up into very small pilules which can be mixed with jelly and thus swallowed (West). The tannate may also be given in powder or with chocolate. It is comparatively tasteless, but has to be given in three times the quantity of the sulphate, and is said not to be so reliable in its action. If quinine cannot be given by the mouth, it may be administered in the form of suppositories or as an enema—double the ordinary dose being used. It may also be given hypodermically, but this method is rarely warranted in children, except in severe malaria.

Strychnine.—Solution of strychnine and tincture of nux vomica are useful tonics, and are usually taken quite well if sufficiently diluted. Of the former, $\frac{1}{3}$ to 1 minim thrice daily may be given to children of one to five years old, and 2 minims to older children. Of the latter, one and a half times these doses may be employed.

Digitalis and Strophanthus.—These are well borne even by young children.

Mineral Acids.—The dilute acids are often of benefit in dyspepsia; and they are useful in diarrhœa, on account of their anti-fermentative action. One or 2 minims of dilute hydrochloric or nitric acid may be given in each dose to infants of from six to twelve months, and from 2 to 4 minims to children of from five to ten years. It is well to dilute the acid to the extent of

a teaspoonful to each minim, otherwise there may be difficulty in getting a child to take the medicine on account of its taste.

Alkalies.—There are few medicines which are so often successful in temporarily improving the condition of weakly children as alkaline tonics. Alkalies are also of great use in the treatment of many nervous and other ailments arising from an acid fermentation of food in the alimentary canal, in lithæmic conditions, and in bacillus coli infections of the urinary tract.

Mercury.—Grey powder, calomel, and solution of perchloride of mercury are much used in childhood, not only in syphilis but also in various dyspeptic disorders, on account of their anti-fermentative action. Calomel is a useful purgative in many conditions. In cases of acute tonsillitis and commencing laryngeal catarrh, the treatment should generally begin with a mercurial purge. The great value of mercury as an adjuvant to digitalis in some cardiac cases has been already referred to (p. 483). One gr. of calomel may be given to a child under twelve months, 2 grs. to one of two years, and 3 grs. to those between three and seven years old; or $\frac{1}{6}$ gr. may be given every hour until the bowels act.

Weak mercurial ointments (*e.g.* nitrate or ammonio-chloride of mercury, 8 grs. to 1 oz.) are very useful in the treatment of impetiginous eczema and of most forms of superficial sore in strumous children.

Opium.—To premature babies and those who are suffering from severe or acute respiratory distress, opium should never be given; but, in many circumstances in childhood, it is a valuable medicine.

It is chiefly of use in relieving pain and in quieting the action of the bowels. It is useful in some forms of diarrhœa, because, by diminishing the rapidity with which the other remedies pass through the bowel, it gives them time to act. It is also sometimes useful in allaying spasm, as in whooping-cough and croup, and in soothing irritable coughs, but it should never be used for ordinary restlessness or to procure sleep. The value of opium during the onset of croupous pneumonia has already been referred to.

The dose must be regulated by the size and strength of the child as well as by his age—a wasted baby of a year old requiring a smaller dose than a big strong child of six months.

Some children are specially intolerant and some more than usually tolerant of the drug. Cases of extreme susceptibility to opium in strong children are very rare indeed, and if reasonable precautions are taken, no danger of poisoning need be feared. The effect of the first dose should always, however, be watched; and if the child is not to be seen again for some time, it is well to instruct the mother not to repeat the medicine if he is drowsy, and to stop it whenever the symptoms for which it is being given are relieved.

Laudanum, nepenthe, and solution of hydrochlorate of morphine (B.P.) may be taken safely by children a year old in doses of $\frac{1}{2}$ to 1 drop, while to those of six months, $\frac{1}{6}$ to $\frac{1}{3}$, and to those of two months, $\frac{1}{20}$ of a drop may be given. A child of twelve months may have $\frac{1}{2}$ to 1 gr. of Dover's powder.

Compound tincture of camphor is a convenient form in which to give small doses of an opiate to children. To infants during the first year 1 drop for each month of their age, and to a child of five years $\frac{1}{2}$ drm. may be given.

Codeine is sometimes helpful in cases of abdominal pain and tenesmus, and for coughs. For a child of a year old, $\frac{1}{2}$ of a grain is a suitable dose and from $\frac{1}{12}$ to $\frac{1}{6}$ of a grain for one of four or five years. Heroin ($\frac{1}{100}$ to $\frac{1}{30}$ of a grain) is sometimes useful in persistent coughs. Morphine may be given hypodermically, in doses of $\frac{1}{30}$ to $\frac{1}{24}$ of a grain, to a strong infant of a year old.

Chloral Hydrate.—Chloral is well borne by children. It is especially useful in cases of infantile convulsions (pp. 544 and 546) and in those which complicate whooping-cough. In young infants, it is best given per rectum (1 gr. for a child of a month, 5 grs. for one of six months, and 10 grs. for one of a year old). It may be given by the mouth to children of one or two years old in doses of $2\frac{1}{2}$ to 5 grs., and to older children in doses of 5 to 10 grs.

Bromides of Potash, Soda, and Ammonia.—The bromides may be given for the irritability of teething, for sleeplessness, and for nervousness of any kind. When a nervous child has to undergo a slight operation, such as excision of the tonsils, without chloroform, it is sometimes advisable to give him a large dose of bromide. Although this will not diminish the pain of the operation, it will make the patient drowsy and lower his sensibilities so that he will suffer less from the fright of it

than he would otherwise do. In a similar way, children who are made very sick by railway travelling are sometimes greatly benefited by a dose of bromide before they start.

Under ordinary circumstances, 1 or 2 grs. every two or three hours may be given to infants of a month or two old, while children of a year or more may have 3 to 5 grs. repeated at similar intervals.

When bromides are being given for any length of time, it is well to combine with them a small dose of liquor arsenicalis to lessen the risk of a bromide acne.

Antipyrine is a very useful drug in childhood under a great variety of circumstances. Its main value depends on its sedative action. To children who are atrophied or prostrate from acute disease it must be given with caution, if at all. Generally, however, it is well borne even by young infants.

It is often valuable in cases of whooping-cough which are not complicated by much bronchitis, and also in chorea. For night-terrors and restlessness, and for laryngismus and spasmodic croup it is a more reliable sedative than the bromides. It is also useful in colic and in the pains accompanying dentition in young infants. In cases of high temperature from septicæmia and pneumonia, it relieves the restlessness even when it has little or no effect on the pyrexia. One gr. every four hours may be given for each year of the child's age during the first three years. For night-terrors, in a child of from five to ten years, a dose of from 5 to 10 grs. may be given.

Belladonna is a drug which children bear remarkably well. The tincture may be given to babies of a year in doses of 2 or 3 minims, and for children of six or eight years, from 10 to 20 minims is a usual dose. It is useful in some cases of broncho-pneumonia, pulmonary collapse, and whooping-cough, and especially in enuresis.

Thyroid Substance.—Thyroid is usually most conveniently administered in the form of Burroughs and Wellcome's Tabloids. It is useful in many conditions besides myxœdema and cretinism. It may sometimes, for example, be given with advantage in obesity, in enuresis, and in some cases of convulsions and of tetany. J. W. Simpson[1] has suggested its use in small doses

[1] "The Thyroid Gland in Relation to Marasmus," *Scot. Med. and Surg. Journ.*, December 1906, xix., 504.

(one $\frac{1}{4}$ or $\frac{1}{2}$ gr. tabloid, once twice, or thrice daily) in infantile atrophy. This treatment certainly deserves a trial. I have seen a number of cases in which it was at once followed by a striking gain in appetite, weight, and vigour, although it often fails altogether.

Emetics.—In acute indigestion, emetics are valuable in getting rid speedily of the contents of the stomach. In bronchitis also they are of great use in helping to clear out of the bronchi any secretion which may be blocking them and which is not effectually removed by coughing.

The most effectual and safest emetic is powdered ipecacuanha, and it should be given in 5-gr. doses every ten minutes until vomiting occurs.

Ipecacuanha wine acts well when it is fresh, but its emetic properties are greatly diminished by keeping. We may also give sulphate of copper ($\frac{1}{2}$ gr. every ten minutes) or alum (1 drm. in syrup at similar intervals). Apomorphine should not be used, as it is too depressing.

Purgatives.—Castor oil is generally regarded as the safest and most reliable of purgatives. Its taste, which is its chief disadvantage, may be disguised, to a considerable extent, if the dose is shaken up in a bottle with a wine-glassful of hot milk, sweetened and flavoured by a piece of cinnamon having been boiled in it. Another successful device is to give the child a mouthful of dry oatmeal immediately before he takes the oil.

Senna may be given in the form of the syrup of senna pods, or as compound liquorice powder. These preparations are easily taken, but they are more apt to cause griping than castor oil. They must always be used fresh.

Rhubarb may be given to older children in cachets, and for younger children the syrup is a convenient form.

Carlsbad salts (a teaspoonful) is a useful form of saline purge for children over four, and a tablespoonful of any of the aperient waters may be given with an equal quantity of hot water or hot milk.

Hypodermic Injection of Medicine.—Subcutaneous injections are extremely useful in certain serious and acute conditions. For example, morphine may be injected in convulsions and cholera infantum, adrenalin in cases of asthma, and ether and strychnine in states of collapse.

Hypodermic Injection of Saline Solution.—The injection of sterilised salt solution into the subcutaneous tissue is often of great value in cases where much fluid has been removed from the body by continued vomiting or diarrhœa.

The necessary apparatus for giving such injections consists in a needle, about the size used for exploring the chest, 2 feet or so of tubing, and, for a funnel, the outer part of a 2-oz. glass syringe. The fluid used is a $\frac{3}{4}$ per cent. solution of sodium chloride, and it, as well as the apparatus, must of course be sterilised by boiling.

The fluid should be considerably above the body temperature to begin with, because it is rapidly cooled in the funnel and tube. When filled, the funnel should be covered completely with cotton-wool, and part of the tube may be allowed to lie in a basin of hot water. The needle may be inserted into the subcutaneous tissue in any convenient part of the body. The back, pectoral regions, abdominal wall, and thighs are the best places. From 1 to 6 oz. of fluid may be used at a time. Generally from 2 to 3 oz. are sufficient. The funnel is suspended about a foot above the patient and the solution is allowed to flow in very slowly. In most cases no pain whatever is caused after the needle is in place. In some children, however, the distension of the tissues seems to hurt a good deal. The skin should be carefully covered with cotton-wool during the injection, as it is apt to get very cold. The puncture is closed with collodion.

Applications of Drugs to the Skin in the form of fomentations and compresses are to be used with great caution in childhood. Carbolic acid is especially dangerous because of the ease with which it is absorbed through the skin and from raw surfaces. It is probable that, in some of the cases of burns which end fatally, death is due largely to the absorption of antiseptic drugs from the surface.

Applications to the Throat.—Morbid conditions of the pharynx and tonsils are generally most satisfactorily treated by the application, with a large brush, of some bland application which will do no harm if it is swallowed. In some children a spray may be used, but in most the brush is more effectual. Gargling should not be ordered for children under seven years, and if it is prescribed at all, care must be taken to make sure that the child understands how to do it.

Applications to the Nose and Naso-Pharynx.—There are various ways of applying alkaline and antiseptic lotions to the nasal cavities and through them to the naso-pharynx. The lotion may be sniffed up by the child from his own palm or may be gently poured into the nostrils from a spoon, the head being tilted back slightly. The best way, however, in young infants is to drop the liquid into the nose by means of an ordinary medicine dropper, while the child is lying on his back.

The Mechanical Treatment of the Stomach.

The mechanical treatment of the stomach has a wider application in young children than in adults. It may be considered under two heads: 1. Forced feeding, or gavage; 2. Stomach-washing, or lavage. Both these measures are simple of application and of great value in suitable cases.

1. *Forced Feeding, or Gavage.*

Methods and Apparatus.—When a child is unable or unwilling to swallow, he may be forcibly fed either by the nose or by the mouth.

(*a*) *Nasal Feeding.*—The simplest form of nasal feeding consists in pouring a bland form of liquid nourishment into one nostril, through which it rapidly finds its way to the pharynx, and is inevitably swallowed. The child must be kept lying on his back and his head held steady. The food given must of course be quite unirritating in character (*e.g.* sterilised milk). The process of feeding must take place slowly, and regular intervals must be allowed for swallowing. Should the food be of a kind which might irritate the delicate nasal mucous membrane, a tube must be used long enough to reach to the back of the pharynx, if not into the œsophagus. In most cases, however, it is advisable to do nasal feeding by means of a catheter which is passed right down to the cardiac opening of the stomach.

For this, a soft rubber catheter (No. 12 or 13—French) is suitable. It is thoroughly lubricated, and passed into the nostril with the patient lying on his back, or in older children while he is sitting up. When the end of the catheter reaches the pharynx, there is often retching, and

some resistance is felt. The patient's head should then be inclined slightly forward, and the tube pushed gently on. As it gains the œsophagus, it generally ceases to irritate the pharynx, and soon the passage of gas and liquid from its upper end indicate that it has reached the stomach.

The catheter may pass into the larynx, but this seldom happens; its occurrence is announced by coughing and dyspnœa. More frequently it passes into the mouth, and this is likely to occur if there is much coughing and retching while the end of the catheter is passing the pharynx. When the catheter has reached the stomach and the retching has stopped, the food is introduced into it through a funnel.

The best funnel for this, and for any similar purpose in children, is formed by the barrel of a glass syringe with a fairly wide nozzle. When the catheter is being withdrawn, its end must be tightly compressed lest its contents get into the larynx in passing.

(*b*) *Forced Feeding by the Mouth.*—This is generally carried out by the passage of a catheter into the stomach. The apparatus required is the same as that used for stomach-washing, viz., a soft rubber catheter, connected, by a small piece of glass tube and a foot and a half of rubber tube, with a funnel large enough to hold from 2 to 6 oz. The size of the catheter used varies with the age of the child from fourteen to twenty (French), and it should be provided with one or two extra eyes.

The child is placed on his back, his head being held steady by an assistant. The left forefinger is then placed lightly on the tongue to depress it, while with the right hand the catheter is passed down the pharynx for 8 to 10 inches. The funnel is raised for a few minutes to allow the escape of gas, and the food is then poured into it and rapidly finds its way into the stomach. When the funnel empties, the tube is tightly compressed and rapidly but gently withdrawn. If the withdrawal of the catheter is done slowly or clumsily, it is apt to excite vomiting.

In infants who have no teeth, or only one or two, no gag is required. In older children some sort of a gag is necessary, as there is danger of the tube being bitten. In them the process is much more difficult and not so generally useful.

A simpler form of forced feeding, first recommended by Scott Battams,[1] is sometimes useful. For this all that is necessary is an ordinary glass syringe, to the nozzle of which 4 inches of rubber tube are attached. The child, who is refusing food or who for some reason is not to be allowed to suck, is laid on his back, the tube is passed towards the back of the mouth, and the liquid is gently injected. In older children, who clench their jaws, the tube may easily be passed backwards between the teeth and the cheek, and the liquid in this way reaches the pharynx readily.

Indications for Forced Feeding.—1. In the rearing of premature infants, periodic feeding, either through the nose with a spoon or by means of a catheter passed through the mouth, has been found of great use (Tarnier).

2. Similarly, in young infants and others who are so weak that the effort of sucking and swallowing exhausts them, great benefit may be got from forced feeding, either through the nose or preferably by Mr Scott Battams' method.

3. In some cases of prostration (*e.g.*, in enteric fever) there is obstinate refusal of all food and medicine to an extent which seriously endangers life. These cases may be effectually treated by one of the methods of nasal feeding, or preferably by the syringe and short tube.

4. The same methods are serviceable in cases where swallowing is interfered with by pain due to ulceration of the mouth or throat.

5. Many years ago Dr Kerley[2] drew attention to the fact that regular forced feeding by means of an œsophageal tube passed into the stomach was sometimes extremely useful in persistent vomiting in infants. Babies who are not able to retain a teaspoonful of fluid swallowed in the ordinary way can usually retain a much larger amount of nourishment if it is poured into the stomach through a catheter. The explanation of this is obscure, but of the occasional value of its application in practice there can be no doubt.

6. In cerebral cases, in cases of narcotic poisoning, and in convulsive conditions such as tetanus, where there is interference with the process of swallowing, life may be prolonged

[1] *Lancet*, 16th and 23rd June 1883, 1037 and 1084.

[2] "Gavage in the Treatment of Persistent Vomiting in Infants," *Archives of Pediatrics*, February 1892, 85.

and sometimes saved by forced feeding with a tube either through the nose or mouth. In diphtheritic paralysis affecting the pharynx, feeding through a tube is of the greatest possible value.

2. *Stomach-Washing, or Lavage.*

Methods and Apparatus.—A soft rubber catheter connected with a funnel by 18 inches of tube constitutes the best apparatus for stomach-washing, as for gavage. The catheter used should be the largest that can be easily passed and should have two or three eyes. Lukewarm ¾ per cent. salt solution is probably the best fluid to use.

The patient is made to sit or lie on his mother's knee, with his face looking towards her left side and his clothes protected by a mackintosh sheet. A slight pressure on his chin generally makes him open his mouth, and the catheter is then passed gently backwards over the tongue and down the œsophagus as already described (p. 816). When the stomach is reached, the funnel is momentarily raised to allow any gas present there to escape and then lowered so that the stomach-contents, if any, may be seen. Then the water is poured into it out of an ordinary jug.

In doing this one must be careful, especially in delicate children, not to overdistend the stomach by running in too much water at a time or by holding the funnel too high. When a sufficient amount of fluid has been introduced, the funnel is lowered, and the contents of the stomach rapidly fill it by syphon action and are emptied into a pail. The tube is then pinched to prevent the entrance of air, the funnel raised again and refilled, and the process of washing-out repeated. It should be continued until fragments of curd, etc., cease to be found in the returning fluid.

Indications for Stomach-Washing. — In many forms of dyspeptic derangement in infancy, stomach-washing, with or without irrigation of the lower bowel, constitutes the most rational and successful preliminary treatment.

It is also frequently, as we have seen, a valuable aid in the diagnosis and treatment of many of the diseases of the alimentary tract in infancy.

The Mechanical Treatment of the Bowel.

Our objects in making local applications to the bowel are five in number. *Firstly*, to stimulate it to evacuate its contents. *Secondly*, to cleanse, soothe, or otherwise act on its mucous membrane. *Thirdly*, to soften retained fæces or to destroy parasites. *Fourthly*, to have food, fluid, or medicine absorbed from it without passing through the stomach; and *fifthly*, to reduce an intussusception or a prolapse of the rectum.

For these purposes we make use of suppositories, injections of various kinds, and irrigations.

Suppositories.—The simplest forms of local irritant that are used to stimulate the action of the bowel in constipation consist of small paper cones or conical pieces of soap. These are quite efficacious in many cases, and are unobjectionable provided the mucous membrane of the rectum remains quite healthy. Glycerine suppositories are more active; but, though they are useful in some cases, they must not be persevered with too long, as they are apt to give rise to catarrh of the rectum and to cause fissures and other troublesome complications.

Enemata.—Evacuant injections may be composed of plain soap and water or thin gruel. During the injection the child should lie on his side, the fluid (at a temperature of 100° F.) should be allowed to run in very slowly and a certain amount of pressure exerted on the sides of the anus so as, if possible, to help its retention for a few minutes. In giving rectal injections to young children, a glass funnel and catheter are much preferable to a Higginson's syringe.

Injections of glycerine are very efficacious in *constipation*. A teaspoonful may be used plain or mixed with an ounce of warm water. In obstinate cases, from 2 drms. to 1 oz. of castor oil, or from 1 to 4 drms. of turpentine, may be added to an ordinary soap and water injection.

Injections of laudanum and starch are very useful in relieving *tenesmus* and some forms of *diarrhœa*. Two to 3 minims in a ½ oz. of starch may be used for a strong child of a year old. In the insomnia of acute disease (*e.g.* in pneumonia), a rectal injection of warm water is sometimes very efficacious.

When *hard masses of fæces* accumulate in the bowel, a preliminary injection of olive oil (½ to 1 oz.) is useful in softening them. It should, if possible, be retained for from

four to six hours, and be followed by an ordinary soap and water enema.

The administration of *medicine* by the bowel is sometimes useful in an emergency when the patient is unable to swallow (*e.g.* chloral in a case of convulsions).

Nutrient enemata are of comparatively little use in early childhood, as in the cases where they might be useful they are scarcely ever retained satisfactorily.

Saline rectal injections, given to allay thirst and to supply fluid to the tissues, form a most valuable therapeutic measure —especially in young babies.

The apparatus necessary for giving such injections consists in the barrel of a glass syringe attached to a small rubber catheter. The catheter is gently introduced for a couple of inches into the bowel, and the salt solution ($\frac{3}{4}$ per cent.), which must be at blood-heat, is allowed to run in very slowly. The catheter is compressed from time to time so as to moderate the flow. When the fluid has entered the bowel, the catheter is withdrawn and the nates are held firmly together for a minute or two. When the rectum is very irritable, as often happens, it may be necessary for the nurse who is giving the injection to take half an hour or longer in its administration. In some very irritable cases the fluid will be ultimately well retained if the nurse allows only a few drops of the fluid to enter at a time and compresses the nates for many minutes at the end.

The right amount of saline to be injected varies in different cases, because it depends on the degree of sensitiveness of the particular child and not merely on the capacity of the rectum. Infants of a few weeks can usually retain from 6 drms. to 1 oz., and sometimes, with care, as much as 2 oz. Older children may retain much larger amounts. The injections may be repeated every four hours. Stimulants may be given in the injection, and are well borne if freely diluted.

Some of the indications for this method of treatment are as follows :—

1. In premature and extremely weak babies who are threatening to die from sheer debility, occasional rectal saline injections are a valuable aid to the use of the incubator and forced feeding.[1]

[1] Pery, "De la débilité, congénitale et acquise, des nouveau-nés," *Thèse de Bordeaux*, 1903.

2. They may also be useful in any diseased condition in newly born or other weakly children (*e.g.* birth injuries, septic conditions, hæmorrhage, etc.).

3. They are particularly valuable in cases where the child is unable to retain fluid taken by the mouth, as in pyloric hypertrophy and other conditions accompanied by severe vomiting, and after surgical operations when fluids are not allowed by the mouth.

4. Large enemata of plain water form a valuable diuretic measure in cases of acute nephritis.

Irrigation of the Lower Bowel.—To irrigate the colon, an ordinary douche apparatus, such as is used in obstetric practice, is required, with a large-sized rubber catheter at the end of the tube. The child is laid on a bed or table or on his nurse's knee in the lithotomy position, and a large mackintosh sheet is placed under him, draining into a pail below. The douche can is fixed 4 or 5 feet above the child. The catheter is then oiled and placed within the anus before the water is turned on. As the water flows, the catheter is passed steadily upwards for 12 or 14 inches, if possible.

At six months old, the colon will hold a pint without distension; and, at the age of two years, from two to three pints (Holt). As the irrigation proceeds, the water begins to be forcibly expelled by the side of the catheter, and the process should be continued until the water which returns is tolerably clean. At least a gallon of water should be used for each irrigation. After the injection is over, the water should be allowed to run out of the catheter, and it should be left in for a few minutes for this purpose. A considerable proportion of the injecting fluid is usually retained for some time.

Irrigation is useful in effecting the thorough clearing out of the lower bowel.

It is soothing to the mucous membrane and has a beneficial effect in various forms of diarrhœa, and also in some cases of recurrent colic. Plain water or saline solution seems to be as efficacious as an antiseptic solution.

Cases of catarrhal jaundice which are threatening to become chronic are sometimes greatly benefited by the daily administration of a cold water irrigation. For this purpose the water may be used between 65° and 85° F.

APPENDIX A

METHOD OF CASE-TAKING

Name—Age—Parent's occupation—Address—By whom recommended. Date of admission. Date of examination. Date of discharge.

Complaint, on account of which the child has been brought. Its duration.

Family History.—Health of parents and near relatives (rheumatism, tubercle, nervous and mental disease, syphilis, etc.)—Mother's health during pregnancy, and facts as to previous pregnancies—Miscarriages—Number of other children alive, their ages and health; number dead, their ages and cause of death.

Hygienic Surroundings.—Dwelling-house (situation, size, ventilation, light, warmth, dampness)—Amount of open-air exercise.

Previous Health.—Nature of labour—Condition of child at birth—Feeding during infancy (breast or bottle—exact details)—Later feeding—Dates of teething and of beginning to walk and speak—Usual state of digestion and bowels—Sleep—Signs of congenital syphilis—Fits (number and date of occurrence)—Rickets—Attacks of diarrhœa, vomiting, bronchitis, sore throat, otorrhœa, enlarged glands—Infectious diseases and age at which they occurred (measles, whooping-cough, scarlet fever, chicken-pox, etc.).

Present Illness.—Date of commencement, and whether sudden or gradual—Health immediately before—Supposed or possible causes (injury, chill, improper feeding, etc.)—Symptoms noticed in order of appearance, *e.g.*, languor, wasting, irritability, debility, loss of appetite, thirst, vomiting, diarrhœa or constipation, cough (its character and time of occurrence), pain, laryngismus, convulsions (general or local), perspiration, fever, breathlessness, sore throat, disturbed sleep, drowsiness, etc.

State of Examination.—Height—Weight.

A. *General Inspection and Palpation.*

Appearance (if healthy or otherwise)—Nutrition and development—Complexion (anæmia, cyanosis, jaundice, etc.)—State of skin (dryness, moisture, eruptions, desquamation, pigmentation, œdema)—Attitude, expression, demeanour, temper.

Shape of head, and state of its ossification (fontanelle, craniotabes)—Facial irritability—Hair—Eyes, nose, and ears (formation of, and if any discharge from)—Neck—Shape of thorax, abdomen, back, and limbs (especially the hands)—Enlarged glands—Evidence of rickets, syphilis, and tuberculosis.

Character of voice, cry, and cough—Rate and character of respiration (if noisy, dyspnœic, or painful)—Movements of alæ nasi—Rate and character of pulse—Temperature.

Palpation of abdomen (tenderness, resistance, fluid, size of liver and spleen, tumours, etc.).

B. *Further Detailed Examination of Systems.* *N.B.*—The systems found to be affected should be taken first, but *in all cases* the urine, heart, lungs, abdomen, and throat must be examined and their condition recorded.

Respiratory System.

Thorax (form, measurement, movements, retraction).
Palpation (position of heart's apex-beat, fremitus).
Auscultation—Percussion—Exploratory puncture—Sputa.

Circulatory System.

Inspection of præcordia, epigastrium, and neck (form, pulsation, etc.).
Palpation (position, character, and force of heart's apex-beat and other pulsations, thrills). Auscultation—Percussion.

Hæmopoietic System.

Spleen (palpation, percussion), lymphatic glands, thymus, thyroid, blood.

Genito-Urinary System.

Micturition (control of bladder, dysuria)—Examination of kidneys, bladder, and external genitals (phimosis, hernia, etc.).
Urine (amount and characters). Microscopic examination.

Skin.

Eruptions (distribution, type, itchiness, enlargement of neighbouring lymphatic glands).

Locomotor System.

Joints, epiphyses, shafts, muscles.

Nervous System.

Cranium (size and shape)—Fontanelle (shape, edges, tension, level, pulsation, and size). Spine (form, pain, rigidity, retraction of head).
Mental condition—drowsiness, stupor, coma, disturbances of sleep, irritability, excitement, delirium, attention, memory, intelligence, speech.
Motor Functions.—Muscles (development of), paralysis.

Involuntary movements (tremor, chorea, spasm—tonic, or clonic, convulsions).

Voluntary movements (strength and co-ordination).
Holding up head, sitting up, standing, walking.
Electrical reactions.
Reflexes, superficial, deep, organic.

Sensory Functions—subjective sensations, sensibility to touch, pain, and temperature, tenderness (local or general).
Vasomotor and Trophic Functions.
Eyes—sight, photophobia, conjunctiva, cornea, pupils (size, shape, and reaction), nystagmus, strabismus, ptosis, muscular paralysis, ophthalmoscopic examination.
Ears—pain, discharge, hearing, otoscopic examination.
Nose—smell, taste.

Digestive System.

Lips, mouth, tongue, gums, teeth, palate, tonsils, fauces, pharynx, adenoids.
Thirst, appetite, vomiting, state of bowels, vomited matter, fæces.
Abdomen (further inspection, palpation, percussion). Rectal examination.

DIAGNOSIS. TREATMENT AND PROGRESS. RESULT.
IN CASE OF DEATH, COPY OF PATHOLOGIST'S REPORT.

APPENDIX B

PERIODS OF INCUBATION AND INFECTIVENESS OF INFECTIOUS DISEASES

THE following facts are taken partly from the Clinical Society's *Report on the Periods of Incubation and Contagiousness of Certain Infectious Diseases*, London, 1892, and from the *Code of Rules* issued by the Medical Officers of Schools Association, sixth edition, London, 1910:—

Diphtheria.

Incubation Period.—This generally lasts two to five days, and never exceeds ten days. Quarantine, twelve days.

Infective Period.—The patient may be infectious for nearly four weeks. He may return to school in four weeks, provided that convalescence is completed, that there is no longer any sore throat, nor any abnormal discharge from the throat, nose, ears, or eyes, no cutaneous pustulation and no albuminuria, and that at least two successive bacteriological examinations of both the pharyngeal and nasal mucus for the specific bacillus have given consistent negative results—each examination having been made not less than three hours after the discontinuance of local antiseptic applications.

Persistence of Infection.—The infection can be retained in clothes, carpets, and other fomites for months, perhaps for years.

Enteric Fever.

Incubation Period.—The duration varies very much. It generally lasts from twelve to fourteen days ; may only be eight or ten, or possibly less ; in rare cases, fifteen, eighteen, or twenty-three days.

Infective Period.—This lasts from the onset of the first symptoms until convalescence has been established for at least a fortnight.

Persistence of Infection.—Fomites may retain the infection for two months at least.

Influenza.

Incubation Period.—This usually lasts three or four days, but varies from a few hours to five days in duration.

Infective Period.—The patient may convey infection during the whole course of the illness, *i.e.*, for a week or ten days.

Measles.

Incubation Period.—This usually lasts for ten days, rarely only for four or five, or for as long as fourteen days. Generally the rash appears on the fourteenth day from exposure to infection. Quarantine, sixteen days.

Infective Period.—Measles is very infectious during the invasion, and probably remains so during the whole of the acute attack. The infection may last for almost two weeks from the beginning of the rash.

Persistence of Infection.—Fomites are probably capable of retaining infection for a very short time only.

Mumps.

Incubation Period.—The interval between the exposure to infection and the onset of parotitis is generally three weeks, or a day or two more or less. It is occasionally as long as twenty-three days, or, more rarely, as short as fourteen days. The beginning of the prodromal stage is so difficult to ascertain, and so uncertain in duration, that the beginning of the illness is usually dated from the onset of the parotitis. Quarantine, twenty-four days.

Infective Period.—This may begin with the beginning of the prodromal stage, which may last as much as four days ; it is very active during the onset of the parotitis ; it diminishes progressively from that time, and may be regarded as having ceased any time after a fortnight, provided a clear week has elapsed since the subsidence of all swelling.

Rubella.

Incubation Period.—This lasts usually for eighteen days, but may be as long as twenty-one, or rarely as short as nine days. Quarantine, twenty days.

Infective Period.—The patient may be infectious for two or three days before the rash appears, as well as when it is out. The infection probably

passes off within five days of the appearance of the rash, provided there is no persistence of nasal or other symptoms.

Scarlet Fever.

Incubation Period.—This usually lasts for more than twenty-four, and less than seventy-two hours. It is occasionally less than a day, and sometimes longer than three days; it never exceeds seven days. Quarantine, ten days.

Infective Period.—It is infectious from the onset of the earliest symptoms; but probably ceases to be so long before desquamation is completed, unless there is any nasal discharge, otorrhœa, suppurating wound, or eczematous patch. When any of these is present, the discharge from them may continue very infectious for a long time after desquamation has ceased. When none of these sources of discharge is present, the patient is probably free from infection by the end of the fourth week.

Persistence of Infection.—This infection is readily preserved in, and conveyed by, fomites.

Smallpox.

Incubation Period.—This is commonly twelve days, but not uncommonly a day more or less. It is occasionally only nine or ten days, and sometimes fourteen or perhaps fifteen days. Quarantine, sixteen days.

Infective Period.—The patient is infectious from the onset of the first symptoms, until all the scabs have cleared off, and all skin lesions are healed. It is most infectious during the height of the active stage of the disease.

Persistence of Infection.—Fomites readily carry and retain the infection.

Varicella.

Incubation Period.—This lasts generally for fourteen days, but may be a day less, or four or five days more. Quarantine, twenty days.

Infective Period.—The patient is infectious at least as soon as the rash appears. A convalescent patient may convey the infection to others, so long as any scabs are left on the body or scalp. The infection may be conveyed in clothes, but is certainly not long retained by them.

Whooping-Cough.

Incubation Period.—This lasts usually for fourteen days, but may extend from seven to nineteen days. Quarantine, twenty-one days.

Infective Period.—Whooping-cough is very infectious during the invasion, and while the spasmodic cough is developing. By the end of the fifth week of the cough, the infection has probably always ceased.

Persistence of Infection.—Fomites are probably capable of retaining infection for a very short time only.

APPENDIX C

NOTE ON ANAPHYLAXIS[1]

It has long been known that many foreign proteins may be injected into the body without producing any direct effect; if the injection is repeated, however, a complex effect arises. With each injection, the body becomes more sensitive to the protein, until a condition is established in which a dose of the substance, originally harmless, acts as a vigorous poison. This result is known as "Anaphylaxis" which means the opposite of phylaxis or protection; it is also spoken of as "Allergy," and the animal which has been injected is said to be "sensitised" to the particular protein which has been given. For this reaction to take place, it is necessary and sufficient that an incubation-period of from ten to forty days should elapse between the moment when the protein enters the system, and the moment when the animal becomes sensitised or anaphylactised. It may remain so for a very long period (one or two years or more)—the time varying with the receiving organism and with the nature of the poison introduced.

The simplest explanation of the process of anaphylaxis is that the foreign protein given produces a new substance in the receiving organism which, though not itself toxic, is capable of combining with any subsequent dose of the same protein so that an active poison results. The symptoms of anaphylaxis are believed to be those of poisoning with this secondarily produced toxin.

The occurrence of anaphylaxis in the human body was first observed in 1903 by von Pirquet and Schick in connection with "serum-disease," and, for some time after its recognition, it was believed that it did not occur unless the foreign protein which caused it was *injected*, either subcutaneously into the peritoneum, or into a vein. For it was shown that the same protein could usually be taken freely by mouth without any ill effects, because the process of digestion destroyed its toxicity and rendered it altogether harmless.

During the last few years, however, important observations have been made which show (1) that, in many infants, owing to an inherited weakness, foreign proteins are able, from birth, to pass unchanged into the circulation through the normal alimentary mucous membrane; and that, when they are thus absorbed, they set up a sort of "suppressed" or "modified" anaphylaxis, and produce symptoms somewhat similar to those which, it was formerly believed, could only be caused by their injection. It has also been found (2) that, in some young children, diseased conditions of the mucous

[1] The reader who wishes to know more of this important subject is referred to Dr Chas. Richet's interesting book on *Anaphylaxis* which has been translated into English by Dr Murray Bligh, London (Constable), 1913. Much has recently appeared in American Journals on the relation between anaphylaxis and such conditions as asthma, eczema, and idiosyncrasies to eggs and other foods in children. (See O. M. Schloss, *Amer. Journ. Dis. Child.*, 1912, iii., 341; F. B. Talbot, *Bost. Med. and Surg. Journ.*, 1914, clxxi., 708; and B. Raymond Hoobler, *Amer. Journ. Dis. Child.*, Aug. 1916, xii., 129).

membrane of the stomach and bowels are capable of impairing the protecting power of these parts in such a way that they allow foreign proteins to pass unchanged into the circulation in sufficient amount to give rise to a modified anaphylaxis.

The whole subject of anaphylaxis in its relation to disease is extremely complicated and difficult, and many of its most important details are still quite obscure ; but there can be no doubt whatever that it is destined, in the near future, to play an essential part in the explanation of several morbid phenomena which we have not hitherto been able to understand. As examples of these we may mention urticaria, some forms of infantile erythema and eczema, angioneurotic œdema, suddenly developing rhinitis, irritability and sleeplessness, hay-fever (anaphylaxis to pollen), polypnœa, asthma, certain kinds of convulsions, some obscure types of vomiting and diarrhœa which both set in and cease abruptly, and the idiosyncrasies which some children show for such common foods as cows' milk, eggs, various kinds of meat and fish, beans, and other vegetables, oatmeal, and some fruits. The subject of anaphylaxis may also be expected to throw light on some of the obscure problems connected with zymotic disease.

In the anaphylaxis which results from the experimental injection of foreign proteins, the symptoms vary greatly in severity in different cases and are sometimes extremely acute and severe, so that the animal passes rapidly into a state of coma, with muscular inertia, complete insensibility, mind-blindness, dyspnœa almost amounting to asphyxia, and very great lowering of the arterial blood-pressure ; and death may result. The sudden onset, however, may be followed by a very rapid disappearance of the symptoms, so that the cases may quickly and completely recover after they have appeared hopeless. Sometimes owing to the occurrence of internal hæmorrhage, or serious lesions of the nerve-cells, permanent damage results.

The clinical manifestations of modified anaphylaxis, though similar in character, are generally much less severe. In children, as in experimental animals, these symptoms may be arranged in five groups according to the parts of the body affected. (1) In *the Skin*, we have roughening and miliary rashes on the neck and chest, urticaria, erythema, local or general, and some varieties of eczema. (2) In *the Upper Air-Passages* in babies, as in guinea-pigs, we often have symptoms of "a dry cold"—rubbing the nose, snuffling breathing and sneezing ; and (3) in *the Lower Respiratory Tract*, rapid breathing without dyspnœa, wheezing, and a croupy cough ending sometimes in regular asthmatic symptoms ; (4) in connection with *the Alimentary Canal*, there may be sudden vomiting and diarrhœa, and these are often associated with skin-changes. (5) *The Nervous Symptoms* are such as general irritability, restlessness, fretfulness, and insomnia, and probably certain types of convulsions. Among the characters which these clinical manifestations have in common are their sudden apparently causeless onset, and their rapid and complete recovery. They do not all occur together, but various of them alternate. As the patient becomes increasingly sensitised, they grow in severity and in variety—getting more frequent and more severe as the protein which causes them (*e.g.* milk) is given in larger amounts.

The tendency to suffer from modified anaphylaxis is often hereditary; and we find, in many cases, that the patient's parents or grandparents have suffered more or less from such conditions as asthma, hay fever, or urticaria, or have shown an idiosyncrasy to some common form of food.

Diagnosis.—It is often impossible to make sure that the symptoms present depend on anaphylaxis; but, when they are such as might be due to the absorption of a foreign protein, the diagnosis is strengthened if a decided degree of eosinophilia is found; and, in many cases, it can be confirmed by obtaining a positive cutaneous reaction. Thus, Schloss was able to show by a simple skin test that some of his patients were sensitised to eggs. When white of egg is rubbed into the unbroken skin of the flexor surface of the arm, after cleansing with soap and spirit, a wheal appears within five to fifteen minutes, if the patient is very sensitive. In those who are less so, a similar wheal is produced in this way if the skin, after cleansing, is scarified by a linear scratch or by a round puncture like that used in von Pirquet's tuberculin test. As mentioned elsewhere (p. 522) a similar skin test may be done with the proteins of other kinds of food and with those of various pollens.

Treatment.—In treating a child who is liable to anaphylaxis, with the view of preventing its recurrence, one of two courses may be followed:—either the offending protein may, in future, be altogether banished from his diet, or, as is usually better, when the substance in question is an important food like milk or eggs, an attempt may be made to accustom him to it by giving it in minute doses, at short intervals, until immunisation is established. For example, if the symptoms are produced by eggs, the child may be given capsules containing very small quantities of egg-albumin—beginning with 1 milligramme, or even less, once a day—care being taken to start below the limit of tolerance, and gradually to work up to larger doses. It is interesting to note that Schloss found that immunisation to white of egg, obtained in this way, made the patient also immune to the protein of oatmeal, and to that of almonds to a certain extent.

The symptoms affecting the skin, respiratory, and digestive organs have to be dealt with on the usual lines; and their treatment need not be considered here. It may be well, however, to refer to the usefulness of chloral in the case of the nervous manifestations. According to Richet, when a guinea-pig with anaphylaxis is under the influence of chloral "the anaphylactic shock is inhibited and the *animal awakes vaccinated.*" This is due to the fact that chloral and other similar drugs "have the general property of suppressing all nervous intoxication, probably because the chemical action of the anæsthetic on the nerve-cells prevents the protoplasm of the neuron from entering on any other chemical combination." In the same way, chloralised animals can bear large doses of strychnine and other convulsionary drugs, without any fits occurring. The strikingly beneficial results often observed from the treatment of a certain kind of convulsions in young infants by large doses of chloral (p. 546) is probably to be similarly explained. When severe nervous symptoms, especially convulsions, which may be manifestations of anaphylaxis, occur in children, an attempt should therefore always be made to check them by bringing the patient fully under the influence of chloral for a time.

APPENDIX D

ON ACCESSORY FOOD FACTORS OR VITAMINES

It has long been known that our bodies are composed of proteins, fats, carbohydrates, salts, and water, and that our food must contain these substances in sufficient quantity and in due proportions, if it is to be able to repair the tissue waste, and to furnish the energy necessary for carrying on the various vital activities of the body. Within quite recent times, however, it has been proved that these materials alone are not capable of maintaining life, and that the food must also contain certain other substances, the composition of which is as yet undetermined and to which the names of "Vitamines" and "Accessory Food Factors" have been given. Although these substances have been proved to be essential to life, their chemical structure, and the exact way in which they act, are quite unknown. The quantity of them required for health is probably very small. The reason why artificial, purified, and preserved foods are often so unsatisfactory in the maintenance of health has been shown to be connected with their lack of, or deficiency in, these accessory food factors.[1]

It is believed that there are probably a considerable number of different vitamines; but, as yet, most of the work that has been done on the subject has related to three of them. These are distinguished by their varying solubility in water and other media, and by their different powers of resistance to heat and other agencies. They are all products of the plant world, the animal body being quite unable to manufacture any of them.

The symptoms which arise from a lack of the different vitamines vary in each case; but, in all, a deficiency of them, even when the diet is otherwise adequate for normal nutrition, causes an arrest in the natural growth of the body, and leads in time to death. The diseases which are caused in this way, such as beri-beri, pellagra, scurvy, and rickets are conveniently grouped together as "deficiency diseases."

The first of the accessory food factors to be discovered was that which is called "Water Soluble B," and sometimes the "antineuritic vitamine." It is contained in the embryo or "germ" of cereal grains. When such grains are "purified" by manufacture so that their germ is removed, as it is in polished rice and superfine wheat flour, they are improved in appearance and in taste; but, at the same time, they are rendered unfit to constitute a whole diet, and, if used as such, become a serious cause of disease. Thus "polished" rice produces beri-beri, and the administration of the "polishings" of the rice rapidly cures it.

The second of the accessory food factors investigated is known as "Fat Soluble A." It is found in most animal fats, though not in lard, and is especially abundant in cream, and in such fish-oils as cod-liver oil. It is absent, or present only in small quantity, in vegetable fats. It exercises an especially important function in promoting the growth of the body.

[1] See F. G. Hopkins, *Journ. Physiol.*, 1912, xliv., 425; J. C. Drummond, *Lancet*, 1918, ii., 482; W. D. Halliburton, *Brit. Med. Journ.*, 1919, i., 583.

Owing to their want of this vitamine, vegetable margarines are dangerous for children, if given as their chief source of fat. Probably rickets is due to a deficiency of this food factor. Fat Soluble A is present in high concentration in the green parts of plants.

The third known variety of vitamine has been called "Water Soluble C." It is the antiscorbutic principle, and is found in large amount in fruit-juices, especially those of the orange and lemon, and in most vegetables. It is destroyed by moderately high temperatures and also by treatment with alkali, by desiccation, and by canning and similar processes.

The growing infant requires a relatively larger amount of accessory food factors than the adult does, and suffers more from a want of them in his food. When they are not present in a sufficient amount in the diet, there occurs, sooner or later, an arrest of growth and a decided lowering of the natural resistance to disease. These do not, however, appear at once, for the body seems to have the power of accumulating a reserve of vitamines in its tissues, for use in dietetic emergencies, and it takes some time before this becomes exhausted.

Of the three known accessory food factors, Fat Soluble A and Water Soluble C seem to be those which are of chief importance in infant feeding ; but, seeing that Water Soluble B is present in considerable amount in milk, it also probably has some necessary function there.

When the constituents of a baby's food are entirely derived from good fresh milk, there is little danger of its being deficient in vitamines ; but, when other substances are used, such as vegetable oils instead of cream, danger of ill-health is sure to arise.

The subject of the accessory food factors is one of the highest importance, and it has very extensive bearings. Our knowledge of it has already enabled us to explain, and to treat more efficiently, several important and well-defined diseases ; and it is probable that its further study will show that many less definite diseases and defects, which are at present obscure, are also of the nature of deficiency diseases, and curable on similar lines. Mrs Edward Mellanby's excellent work on the causation of defective formation of the teeth is probably the first of a series of such discoveries.

APPENDIX E

A SIMPLE TECHNIQUE FOR INTRAVENOUS INJECTIONS IN INFANTS

Dr Ann Martin [1] has described, as follows, a method of giving intravenous injections in infants, by way of the superior longitudinal sinus, which has been largely used in the Royal Edinburgh Hospital for Sick Children during the last few years and has proved very satisfactory.

[1] *Brit. Med. Journ.*, 8th July 1916, ii., 40.

"On account of the small size and inaccessibility of the superficial veins in young infants, it is usually difficult and often impossible to give intravenous injections, or even to obtain sufficient blood for the Wassermann reaction by the methods ordinarily employed. The difficulty is satisfactorily overcome by puncturing the superior longitudinal sinus through the anterior fontanelle, according to the procedure recently introduced by Helmholtz of Chicago.[1] . . . The results of saline injections given in this way have been altogether better than those of the subcutaneous method hitherto employed. The following description of the technique of the Helmholtz method, based on a series of fifty cases, is offered as a guide.

"The scalp over the anterior fontanelle is shaved and disinfected with iodine. No anæsthetic is required. The child lies in bed with its head raised to a convenient angle on two pillows. A nurse holds the head securely with a hand on either side; the operator stands in front and on the right side of the child. The needle (held at an angle of about 50 to 60 degrees with the plane of the fontanelle) is inserted in the middle line, half way between the anterior angle and centre of the fontanelle. Some little force is required to push the needle through the firm pericranium, and, when the resistance is overcome, one can feel that the point of the needle is in a cavity. The point should not penetrate more than one-eighth of an inch below the surface of the skin since the sinus lies immediately under the pericranium. If the needle is in the sinus, blood flows at once into the syringe; should this not happen the needle has gone too deep, and has passed completely through the sinus. This is the mistake usually made by a beginner; it does not, however, cause any damage. It is rectified by gently withdrawing the needle until the point re-enters the sinus, as is shown by a flow of blood into the syringe.

"A specially ground needle is essential. The sinus is in many cases so shallow that an ordinary long-pointed needle pierces the inner wall before the entire opening in the end of the needle is through the pericranium. A needle of size No. 20 or thereabouts, with a bevel measuring 2 mm., should be chosen in place of one with an ordinary bevel, which measures about 4·5 mm.

"When introducing fluid, such as eusol or saline solution, we have found a two-way stop-cock and 10 or 20 c.c. syringe, as described by Graham,[2] the most satisfactory instrument. The needle is inserted with the syringe only a quarter full of fluid, as it is easier to manipulate thus. Very little pressure is needed to inject the fluid, which, indeed, flows in almost of itself on account of the slightly negative pressure in the sinus. If pressure is needed, one may be sure that the needle has escaped from the sinus; usually it has been accidentally pushed in too far. Each time the syringe is refilled it is well, immediately before injecting the fluid, to make sure that the needle is still in position by slightly withdrawing the plunger so as to ascertain whether there is a reflux of blood.

"Autopsies on patients on whom, for diagnostic or therapeutic purposes, the sinus had been punctured, at intervals of from a few hours to several

[1] *Amer. Journ. Dis. Child.*, Sept. 1915, x., 194.
[2] *Brit. Med. Journ.*, 6th May 1916, i., 632.

weeks before death, showed that in no case had any injury been done, nor in any case in which this method has been used, have any untoward symptoms followed. The advantage of using the superior longitudinal sinus is evident. I have never found it necessary to give an anæsthetic. The puncture causes little disturbance, and infants even fall asleep while the fluid is running in. There is also the very material advantage that repeated injections, if such are necessary, are as easily performed as the first."

APPENDIX F

NOTE ON THE TYPES OF PNEUMOCOCCI AND ON THE SERUM TREATMENT OF PNEUMONIA

THE cause of pneumonia in children, as in adults, is of course the pneumococcus in the vast majority of cases. Its action need not be discussed fully here, but the recent work on the subject is of such practical interest and importance that a few points regarding it may be mentioned.

When it was proved many years ago that pneumococci were very frequently present in the mouths of healthy people, it was naturally supposed that the lung-affection in cases of pneumonia owed its onset, either to the virulence of these organisms becoming increased in some way, or to something having happened that lowered the resistance of the tissues. Although many points still require to be further studied, it seems now to have been satisfactorily established by immunological tests,[1] that there are at least three other varieties of pneumococci, besides that which normally inhabits healthy mouths. These other types have been shown to be responsible for 80 per cent. of pneumonias, while the normally occurring organisms ("Type 4") only cause about 20 per cent. of them. It has also been found that the mortality of the cases due to Type 4 is considerably lower than that of those caused by any of the other types. In the cases, due to the more virulent varieties, that make a straightforward recovery, it has been found that the virulent diplococci in the mouth usually disappear rapidly; and that, if any pneumococci are found there after the crisis, they belong to Type 4.

We must therefore regard pneumonia as a disease which in most instances arises, not autogenously, but from contact either with patients who have the disease, from convalescents, or from pneumococcus-carriers whom these have infected. It is not, at present, possible to distinguish cases due to the different types of organism from one another, either by cultures or by clinical symptoms; but further work may render this practicable. It is probable that the infectivity of the different types of pneumococci varies considerably in different races, for F. S. Lister has made the interesting

[1] Avery, Chickering, Cole, and Dochez, *Monogr. of Rockefeller Inst. for Med. Research*, No. 7, 16th Oct. 1917, 1.

observation that pneumococci of the No. 4 type, though they have little virulence for white men, readily produce severe attacks of pneumonia in South African natives.[1]

From these observations it is evident that disinfection, and precautions against contagion, are much more important in pneumonia than used to be thought.

Serum Treatment.—During recent years, valuable work has also been done on the serum treatment of pneumonia by F. S. Lister, Avery, Chickering, Cole, and Dochez, and many others. The details of the treatment, however, necessitate the determination of the type of pneumococcus present, and the method is not practicable as yet for sporadic cases in private practice here. When the disease prevails as an epidemic in places where the co-operation of a skilled bacteriologist is available, and when the proper serum can be obtained, it should certainly be tried; for in their small series of cases Avery and his collaborators seem to have been able to reduce their mortality very considerably by its use.

APPENDIX G

DIRECTIONS TO MOTHERS RESPECTING PARALYSED CHILDREN

In Use at the Great Ormond Street Children's Hospital.

Clothing.

THE paralysed parts must be kept warm day and night.

Knitted woollen stockings to come up above the knees must be worn.

If these do not keep the limbs warm, woollen overalls must be worn outside the stockings.

The overalls must be lined, if necessary, with cotton wadding quilted to them.

For the night a flannel sack made the shape of the leg, coming up to the top of the thigh and lined with cotton wadding, is best.

Rubbing.

This must be done for a quarter of an hour twice daily.

Lay the child on a bed.

1st.—Rub the paralysed leg from the foot right up to the top of the thigh. Rub upwards only. Put the broad part of your hand on the back of the child's leg. In rubbing the thigh, put your hand, first

[1] F. S. Lister, "Special Serological Reactions with Pneumococci from Different Sources," *Publication No. 2 of the South African Institute for Med. Research*, 1913; also "Experimental Study of Prophylactic Inoculations, etc.," No. 8 of same Publications, 1916.

on the back of the thigh and afterwards on the front, but always rub upwards, and be sure to go as high as the child's loins. Whilst rubbing with your right hand, hold the child's foot with your left. Use for rubbing any kind of oil.

2nd.—Take hold of the child's leg with your two hands just above the ankle. Rub round the leg with your two hands in opposite directions, as though you were wringing out sheets. Work up the leg and thigh, from the foot up to the top of the thigh, in the above manner.

3rd.—Take the child's calf with your two hands. Put your fingers to the back of the leg and your thumbs to the front. Squeeze the soft parts out between your fingers and thumbs, so as to flatten the leg out and make it as wide as possible. Work right up the leg and thigh in this manner.

4th.—Put your right hand over the front of the child's knee, and your left hand under the foot. Push up the foot, and holding your right hand in front of the child's knee you will prevent yourself doing any harm. You want, if possible, by pushing the foot, to make the child push against your left hand with all its might. *This is the most important of all the exercises.*

5th.—Flip every part of the leg and thigh with your fingers, so as to make the whole of the limb quite red and warm.

6th.—Gently rub up and down all over. This will take away the stinging which was left by the last movement.

Baths.

Once a day let a large jugful of hot water, containing two handfuls of salt, be poured down the leg and thigh.

Then pour about half the quantity of cold water over the leg and thigh.

Then rub thoroughly with a towel until the limb is perfectly warm and dry.

APPENDIX H

DIRECTIONS TO THE MOTHERS OF YOUNG CHILDREN WHO ARE MENTALLY DEFECTIVE

YOUR child needs to be carefully taught to do things that other children do without teaching. In time he may learn to do them quite well if you only persevere.

Remember that improvement *cannot* be sudden; it can only come gradually by getting him to do over and over again little things that he is not good at. Notice, therefore, what things he cannot do as well as other children, and try to teach him to do them better one by one. Do not go on doing for him anything that you can possibly get him to do for himself —such as feeding or dressing.

Encourage him especially in doing those things that he finds a *little* difficult, but do not give him anything to do that is quite too hard for him. Utter failure will discourage him, while success in *anything* that is not mischief will do him a great deal of good.

Always encourage anything harmless that he does of his own accord. Such things please him far more than what you tell him to do, and are also better for him ; but *never* let him even begin to get into a habit of making faces, or of making any noises that you would not like your other children to learn.

If he seems to notice too little, encourage him to look at, and listen to, or handle anything that he is taken up with. Any sort of interest helps to brighten him.

Do your best to keep his body as strong as possible by carefully seeing to his food and clothing, and by taking him into the fresh air as much as you can.

Nobody knows how much he may improve ; that will depend largely on the amount of trouble and patience you spend on him..

APPENDIX I

FORMULÆ

Form. 1, pp. 51 and 52.

Acid Tartrate of Potash	2 grains
Chloride of Sodium .	2 „
Saccharine . . .	¼ grain
Water to . . .	1 ounce

One ounce to be used to wash out the mouth after each meal, and no water used after (Gibbs).

Form. 2, pp. 51 and 52.

Acid Tartrate of Potash	2 grains
Tartaric Acid . .	1 grain
Saccharine . . .	¼ „
Oil of Lemons . .	3 minims
Water to . . .	1 ounce

(Pickerill).

Form. 3, p. 100.

Tannic Acid . . .	30 grains
Carbolic Acid . .	30 minims
Glycerin to . . .	1 ounce

Form. 4, p. 100.

Iodine	6 grains
Iodide of Potassium .	12 „
Peppermint Oil . .	4 minims
Glycerin to . . .	1 ounce

Form. 5, p. 100.

Boroglyceride . .	3 drachms
Glycerin to . . .	1 ounce

Form. 6, p. 127.

Bicarbonate of Soda .	3 grains
Aromatic Spirit of Ammonia	1 minim
Spirit of Chloroform .	1 „
Syrup	10 minims
Dill Water to . .	1 drachm

After each meal.

Form. 7, p. 127.

Bicarbonate of Sodium .	2 grains
Papain (Finckler) . .	1 grain

Before each meal.

Form. 8, pp. 131 and 258.

Sulphate of Magnesia .	2½ grains
Dilute Sulphuric Acid .	1 minim
Sulphate of Iron . .	¼ grain
Syrup of Ginger . .	2 minims
Peppermint Water to .	1 drachm

Thrice daily after food.

Form. 9, p. 139.

Lanolin	4 parts
Soft Paraffin . . .	3 „
Tincture of Benzoin .	1 part

Form. 10, p. 197.

Mercury with Chalk .	⅙ to ¼ grain
Bicarbonate of Soda .	½ grain
Subnitrate of Bismuth .	2 grains

Every two or four hours.

Form. 11, p. 197.

Carbonate of Bismuth .	2 grains
Bicarbonate of Soda .	2 „
Compound Tragacanth Powder . . .	1½ „
Spirit of Chloroform .	1 minim
Caraway Water to .	1 drachm

Every two or four hours.

Form. 12, p. 197.

Carbonate of Bismuth .	7½ grains
Prepared Chalk . .	2 „
Compound Tragacanth Powder . . .	1½ „
Dill Water to . .	1 drachm

Before each meal.

Form. 13, p. 203.

Castor Oil . . .	5 minims
Mucilage of Gum Acacia	15 „
Syrup	30 „
Peppermint Water to .	1 drachm

Three or four times a day.

Form. 14, p. 238.

Cod-liver Oil . . .	18 minims
Syrup of the Lacto-phosphate of Lime .	18 „
Lime Water . . .	18 „
Hypophosphite of soda .	1 grain
Mucilage of Gum Acacia	5 minims
Oil of Cassia . . .	⅓ minim

Thrice daily after food.

Form. 15, p. 238.

Phosphorus . . .	⅓ grain
Cod-liver Oil . . .	3 ounces

A teaspoonful thrice daily after meals

Form. 16, p. 238.

Phosphorus . . .	1 grain
Absolute Alcohol . .	350 minims
Spirit of Peppermint .	10 minims
Glycerin to . . .	2 ounces

Six to twelve drops thrice daily after food.

Form. 17, p. 238.

Phosphorus . . .	⅙ grain
Almond Oil . . .	1 ounce
Gum Acacia . . .	4 drachms
White Sugar . . .	4 „
Distilled Water . .	1½ ounces

One or two teaspoonfuls thrice daily after meals.

Form. 18, p. 252.

Bicarbonate of Soda .	2 drachms
Syrup of Rhubarb . .	2 ounces
Liquid Extract of Cascara	2 „

A teaspoonful after each meal.

Form. 19, p. 258.

Bicarbonate of Soda .	3 grains
Tincture of Nux Vomica	1 minim
Compound Infusion of Gentian to . . .	1 drachm

Ten minutes to half an hour before each meal.

Form. 20, pp. 258 and 265.

Ammonium Ichthyol-sulphonate	1 to 2 grains
Syrup	5 minims
Glycerin	5 „
Water to	1 drachm

Form. 21, p. 336.

Carbolic Acid	½ drachm
Calamine	1 „
Zinc Oxide	2 drachms
Glycerin	3 „
Lime Water	4 „
Water to	4 ounces

Form. 22, pp. 331 and 338.

Prepared Calamine	80 grains
Zinc Oxide	40 „
Glycerin	10 minims
Boric Acid	15 grains
Distilled Water to	1 ounce

Form. 23, p. 345.

β-Naphthol	15 parts
Prepared Chalk	10 „
Soft Soap	50 „
Lard	100 „

Form. 24, p. 348.

Precipitated Sulphur	½ drachm
Ammonio-Chloride of Mercury	½ „
Salicylic Acid	20 grains
Lanolin	½ ounce
Vaseline	½ „

To be thoroughly massaged into the affected spots for at least ten minutes twice daily.

Form. 25, p. 348.

Oleate of Mercury	40 grains
Salicylic Acid	10 „
Lanolin	½ ounce
Vaseline	½ „

As in Form. 24.

Form. 26, p. 350.

Lactic Acid	1 drachm to 1 ounce
Castor Oil	2 drachms
Spirits of Wine	4 ounces

To be applied, with caution, once daily.

Form. 27, p. 350.

Strong Solution of Ammonia	½ ounce
Chloroform	½ „
Oil of Sesame	½ „
Oil of Lemon	½ drachm
Spirit of Rosemary to	4 ounces

To be used cautiously until tolerance is acquired.

Form. 28, pp. 507 and 511.

Ipecacuanha Wine	5 minims
Spirit of Nitrous Ether	5 „
Solution of Acetate of Ammonia	30 „
Cinnamon Water to	1 drachm

Every three or four hours.

Form. 29, p. 507.

Carbonate of Ammonia	1 grain
Ipecacuanha Wine	5 minims
Syrup of Tolu	30 „
Cinnamon Water to	1 drachm

Every three or four hours.

Form. 30, pp. 507 and 519.

Camphorated Tincture of Opium	3½ minims
Ipecacuanha Wine	5 „
Syrup of Squills	30 „
Infusion of Serpentary to	1 drachm

Every three or four hours.

Form. 31, p. 510.

Bicarbonate of Soda	10 grains
Boric Acid	10 „
Chloride of Sodium	5 „
Water to	1 ounce

Lotion for the nose.

Form. 32, pp. 513 and 518.		Form. 33, p. 518.	
Oil of Turpentine . .	1 drachm	Oil of Amber . . .	4 drachms
Compound Camphor Liniment to . .	2 ounces	Oil of Cloves . . .	4 „
		Olive Oil to . . .	2 ounces

APPENDIX J

RECIPES

Albumin Milk.—A litre of whole milk has a tablespoonful of essence of pepsin stirred into it, and is set in water at a temperature of 42° C. (about 108 F.) for half an hour. By the end of this time, a solid mass has been formed by the casein and fat, and the whey has been squeezed out of it. The mass of curd is then placed in a linen bag, through which the whey is allowed to drip for an hour. The firmly contracted curd, which is easily removed from the filter-bag, is then gently but thoroughly rubbed through a fine hair sieve with the aid of a wooden spoon ; this is repeated a second time. During the process, half a litre of water is added. The mixture prepared in this way should have the appearance of milk, its curd being very finely divided. Lastly, half a litre of buttermilk is added to it. The buttermilk is preferred owing to its small proportion of milk sugar, and to its containing lactic acid which is said to have a somewhat stimulant action ; also because it keeps well (Finkelstein und Meyer, *Jahrb. f. Kinderh.*, 1910, lxxi., 537).

Arrowroot Water.—Rub up a teaspoonful of arrowroot with a tablespoonful of cold water until smooth ; pour on it, while stirring, a pint of boiling water, and boil for five minutes.

Barley Jelly.—Put two tablespoonfuls of *washed* pearl barley into a pint and a half of water, and slowly boil down to a pint ; next, strain out the barley, and let the liquid settle into a jelly. Two teaspoonfuls of this, dissolved in 8 oz. of warmed and sweetened milk, are enough for a single feeding.

Barley Water.—Put two teaspoonfuls of *washed* pearl barley into a pint of cold water, boil down to two-thirds of a pint, and strain through muslin. It should be made twice a day, as it may turn sour with keeping.

Beef Tea.—Mince one pound of lean beef, and add to it a pint of cold water and 10 drops of dilute hydrochloric acid ; let it stand for two or three hours, with occasional stirring, and then simmer from ten to twenty minutes.

Brandy and Egg Mixture.—Rub up the yolks of two eggs with a tablespoonful of white sugar, and add four tablespoonfuls of brandy and eight of cinnamon water. Dose, a teaspoonful to a tablespoonful.

Bread Jelly.—Take a thick slice of bread (4 oz.) two or three days old, so as to be dry and sweet, and of seconds flour (since this is richer in protein

and phosphates than the finest white flour), place it in a basin of cold water and allow it to soak for six or eight hours. It is then to be taken out, and all the water squeezed out of it. The pulp is then placed in a pint of fresh water and gently boiled for an hour and a half. The thick gruel thus made is strained, rubbed through a fine hair sieve, and allowed to grow cold, when it forms a fine, smooth, jelly-like mass. It should be freshly prepared, night and morning, for it will not keep long. Enough of the jelly is mixed with warm water, previously boiled, to make a food of the consistence of thin cream (about one full tablespoonful to 8 oz. of water) so as to pass readily through the bottle ; a little white sugar may be added (W. B. Cheadle, *Artificial Feeding of Infants*, 3rd edition, 1894, 84).

Malt Infusion.—Mix three full tablespoonfuls of crushed malt thoroughly with half a pint of cold water in a jug. Allow the mixture to stand overnight—ten or twelve hours. Decant off the supernatant liquid carefully from the sediment, and strain it through two or three folds of muslin, until it comes through fairly clear and bright. This should make about 6 oz. of malt infusion. It should be kept in a well-corked bottle, and a few drops of chloroform are to be added to preserve it. A dessertspoonful may be added to the food before it is taken, or be sipped along with it (Sir Wm. Roberts, *Collected Contributions on Digestion and Diet*, 1891, 224).

Oatmeal Water.—Take one tablespoonful of coarsely ground oatmeal, add a pint of water and simmer gently for an hour ; strain, and add sufficient water to replace that which has evaporated.

Peptonised Milk. — The method of peptonising milk by the use of Fairchild's "Peptonising Powders" is too well known to need description here. Peptonised milk is a valuable help in the treatment of many cases of dyspepsia and debility in infancy. It should not, however, be used regularly in the treatment of healthy babies, as the digestive powers are apt to suffer from want of use when it is given for long. The antiscorbutic element is also very deficient, so that children fed on it are apt to get scurvy. There is less objection to the use of milk which is only partially peptonised. Partial peptonisation can be readily effected by using Fairchild's "Peptogenic Milk Powder." The advantage of partial pre-digestion is that the coagulable protein present is greatly diminished, so that the drawback of the large quantity of casein in the cows' milk is obviated to a considerable extent. The method of preparation is simple, and a paper describing it fully is given with each bottle of the powder. Milk prepared in this way is often very useful in treating young infants. As the child grows stronger, the peptonising can be gradually lessened by substituting milk sugar for the peptonising powder in increasing proportions. Partially peptonised milk is also, however, very deficient in antiscorbutic properties.

Raw Meat Juice.—Mince finely the best rump steak ; add cold water in the proportion of one part of water to four of meat. Stir well together, and allow to soak for half an hour, cold. Forcibly express the juice through muslin by twisting it.

Rules for a Salt-free Diet.—(1) No salt is to be used in cooking, nor is any to be eaten at meal times. (2) Ordinary bread, including cakes and scones from the baker, fish (except fresh-water fish), salt butter, cheese, all forms of dried, smoked, salted, and otherwise preserved food, such as

tinned meat, bacon, dried fish and the like, and sauces and pickles, must be avoided. (3) Not more than a pint of milk must be taken in the day. (4) Soups made from ordinary meat stock contain large quantities of salt; without this they are unpalatable. The soup for a patient undergoing a strict course of treatment should be made from vegetables, with a milk stock. (5) Apart from these restrictions, the patient may eat what he likes. He may have from $\frac{1}{4}$ to $\frac{1}{2}$ lb. of meat, or its equivalent as poultry or fresh-water fish, per day, and vegetables, cereals, bread made without salt, one or two eggs, etc., as his appetite demands. Tea and coffee are not prohibited. The liberal diet which is thus possible is much less irksome than the "light diet" to which many nephritic patients are restricted, and children quickly become habituated to the absence of salt. After a time, the diet may be relaxed somewhat, the addition of ordinary bread being the most grateful change (J. S. Fowler in *Garrod, Batten, and Thursfield's Diseases of Children*, 1913, 637).

Sherry Whey.—Ten oz. of milk are heated until just boiling, then $2\frac{1}{2}$ oz. of *cooking* sherry are added and heat applied again until the mixture begins actually to "boil up," when it is removed from the fire and allowed to stand three minutes. The curd is then strained off through a twofold layer of butter muslin.

Veal Tea.—Take a pound of minced veal, free from fat; mix with a pint and a half of water or barley water; heat in a slow oven for three hours; strain and skim.

White of Egg Water.—Take the white of a fresh egg; cut it in various directions with a clean pair of scissors. Shake it gently in a bottle, with a pinch of salt and half a pint of cold water. Strain through muslin.

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